ELECTRICAL REVIEW

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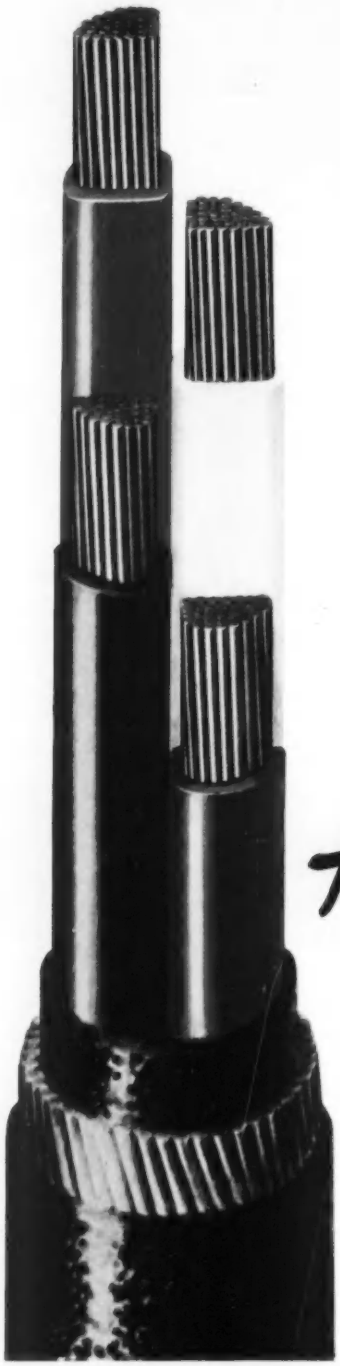

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ELECTRICAL REVIEW

20 February 1959 Vol. 164 No. 8 Established 1872

Contractors' Outlook

THERE are always two or three skeletons at electrical contractors' feasts and there was again a slight rattling of bones at last week's E.C.A. annual dinner, reported on page 365. It seems that it is seldom that things go quite right for the contractors and their problems are perennial. For instance, " kerbstoners " were mentioned by the president, Mr. C. C. Hyams. From the earliest days " legitimate " contractors have suffered from the depredations of incompetent interlopers who defy all the codes and quote unrealistic prices. We believe that the public are now becoming increasingly aware of the dangers of employing " kerbstoners " and with the advent of the National Inspection Council the activities of these people should be even more circumscribed. Although the N.I.C. does not meet the full desires of the E.C.A. that Association should continue to give it wholehearted support, recognising that this form of control is the only one politically possible at present.

Before the nationalisation of the electricity supply industry " municipal trading " was another bugbear. Now there is even greater competition from the Electricity Boards and it has to be recognised that this has come to stay and the only course for the contractors is to come to terms with it. If the Boards compete, as they claim to do, on a commercial basis, the contractors should not be too perturbed; private enterprise, somehow or other, often seems to be able to perform its work more flexibly and cheaply than public authorities.

Labour trouble is perhaps the least tractable of the contractors' problems. It is most unfortunate that relationships with the Electrical Trades Union are so uncordial. It may be that the National Federated Electrical Association (the contractors' organisation for dealing with labour matters) is often " tough," but the Union is consistently aggressive and there is a suspicion that its tactics are not always purely industrial. Operating in this key industry, the E.T.U. has found it possible to demand concessions which have been granted to prevent repercussions in other industries concerned.

But this cannot go on if it increases the cost of electrical installation work to the extent of putting a brake upon development.

The contractors are rightly concerned at the indiscriminate granting of discounts to people who are not entitled to them. Most manufacturers and wholesalers observe the principles of the Electrical Fair Trading Policy but it should be more widely adopted if the electrical industry is to be run on an orderly and stable basis.

It remains to be said that in spite of all their troubles electrical contractors seem to be doing reasonably well —as they should be in our ever-expanding industry.

IMPROVEMENT IN INDUSTRIAL TRENDS

The fourth of its inquiries into industrial trends by the Federation of British Industries indicates that there is some improvement in the general situation. For the first time since the inquiry was instituted, the number of member firms reporting an increase in the rate of new orders, and also increases in levels of output, outweigh, if only by a small margin, those reporting decreases. Against this, the numbers employed continued to decline, and although there has been an improvement in the new order position, this arises wholly in the home market; new export orders, on balance, show further declines. The Federation says that the general expectation of improvement in the future is about the same as it was four months ago. Indications are that in many cases output is expected to rise without an increase in the labour force.

FORWARD WITH EUROPE ?

It was encouraging to find in last week's debate in the Commons such unanimity on the need for a closer association between this country and the Common Market. This is a measure of how far we have come since the last debate over two years ago, but the way forward remains no less obscure. The Government thinks that the path already tried, though blocked, the only one worth taking; the Opposition would like to see the negotiations widened to embrace economic and social questions as well as tariffs and quotas. The initiative at the moment, however, lies with the Common Market countries and the plan which they are to present by 1st March will probably determine what is possible.

The Common Market is now a practical force and its participants have the advantage of knowing to a great extent where they are going. Co-operation is not only taking place at the political level, and on tariffs and quotas, but also between industries. In contrast British firms have only the still nebulous ideal of a Free Trade Area of uncertain form to look forward to. To talk of the Common Market as of little importance, because of the present relatively low proportion of British exports which it takes, is to miss the point. British firms want the opportunity to participate in what is likely to be one of the world's fastest growing markets. The position is urgent if they are not to start with too great a handicap.

ELECTRIC TRAIN ACCIDENT

The report on the official inquiry into the electrical fire which occurred last July in a tube train on the Central Line of the London Transport Railways, reviewed in last week's issue, shows how very easily a serious accident can result from the simplest of electrical faults.

The cause of the accident appears to have been a cracked insulating base carrying cable and circuit terminals into which rain penetrated. This could not have been discovered in normal testing, which would have taken place under dry conditions, when no arcing would have occurred, for the crack was a conducting path under wet conditions only. This seems to indicate that the necessity for preventing the ingress of moisture is as important as the detection of cracks in the insulating base.

London Transport has since stated that modifications have been made and additional safeguards provided in the electrical equipment of all similar tube trains and changes have been made in staff instructions.

Mr. S. E. GOODALL

ON the facing page we reproduce a pencil portrait, especially drawn for us, of Mr. S. E. Goodall, President of the Institution of Electrical Engineers for the 1958–59 session. Mr. Goodall is well known for his work in connection with electric cables. He was educated at Queen Mary College (of which he was later elected a Fellow) and took the London University M.Sc. (Engineering) degree with honours. From 1924 to 1928 Mr. Goodall was with Siemen Bros. & Co., Ltd., and then spent some time in the research department of the Metropolitan-Vickers Electrical Co., Ltd. He joined W. T. Henley's Telegraph Works Co., Ltd., in 1944 as assistant chief engineer; he became deputy chief engineer in 1945 and succeeded Dr. P. Dunsheath as chief engineer in 1946. He was elected to the board earlier this year. Mr. Goodall was chairman of the I.E.E. Supply Section in 1950–51 and he is vice-chairman of the Wiring Regulations Committee. He became a vice-president in 1953.

Mr. S. E. GOODALL, M.SC.(ENG.), F.Q.M.C.

PRESIDENT OF THE INSTITUTION OF ELECTRICAL ENGINEERS

By

B. K. COOPER, Assoc.I.R.S.E.

ELECTRONICS IN THE RAILWAY INDUSTRY

The main use of electronics by the railways is for signalling and traffic control. Many other applications are discussed, including radar, computers and television. At the present stage of development of electronics in the railway industry, a study of the economic and technical advantages to be gained is often as important as the design of the apparatus

NEW trains and modernised stations are the aspects of railway development most familiar to the public at large. Much of the work done to improve and expedite the day-to-day business of handling traffic is little known outside the transport industry. This has been true so far of the applications of electronics in railway working, which have tended to be highly specialised except where they overlap with general industrial practice, as in computing equipment for accounting and similar functions.

From time to time it has been asked why radar has not been applied to problems of railway safety such as avoidance of collision in fog. This question overlooks the fundamental difference between a ship or aircraft, which requires warning of any obstruction in its vicinity, and a train, which is guided on its own track past lineside objects and other trains, all of which would be interpreted as obstructions by a radar set although constituting no danger. The point was dealt with last year in a written reply by the Minister of Transport and Civil Aviation, Mr. Harold Watkinson, to a parliamentary question, in which he referred to technical consultations on the possibility of using radar to prevent railway collisions. The general conclusion had been reached that radar in its present state of development was not applicable to railways despite its proved success at sea and in the air.

There are other directions, however, in which the basic radar principle of scanning a moving object and deriving information from the echo signals can be applied to railway purposes. An important example occurs in the modernisation of marshalling yards. The practice of "hump" shunting, in which wagons are propelled over a hump and then run down by gravity into sidings appropriate to their destinations, is basically an old one, but has been the subject of much development. At one time the speed of wagons entering the sidings was checked by shunters running alongside and applying the brakes with their poles.

Close-up of Metropolitan-Vickers—G.R.S. radar beam projector for measurement of wagon speed at Thornton marshalling yard, Scottish Region, British Railways

An important step forward was the use of retarders or rail brakes for this purpose, under remote control from a control tower commanding a view of the sidings. Considerable skill and judgment were still required in applying the appropriate retarder pressures to wagons of different weights and running characteristics, and means were sought of relating the retarder pressure automatically to the actual measured weight and speed of the approaching wagons.

Automatic control of retarder pressures was introduced in some of the large marshalling yards in the United States after the war and is in operation to-day on British Railways at Thornton Yard, Fife, in the Scottish Region. Similar principles are to be used in the new Eastern Region yard at Temple Mills, near Stratford, and at the Margam Yard, South Wales, of the Western Region. In such installations the speed and acceleration of wagons descending the hump are generally measured by observing the Doppler frequency-shift effect in the echo signals returned from them as they approach a narrow-beam v.h.f. aerial installed in the track. This information, together with a weight measurement generally derived from rail deflection, is fed into a computer together with an input representing the speed at which the wagons should leave the retarders having regard to the distance they have to run before coming to rest. The signal derived from a comparison of the actual speed with the desired exit speed is used to control the retarder pressures as the wagons pass through them until the correct value is reached, when the retarders release their grip.

While it is the present practice in this country to provide the control tower operators in marshalling yards with lists of wagon destinations compiled by checkers from the labels on the vehicles, another method is to furnish them with the actual wagon numbers in conjunction with a list of the train make-up on which the destination of each numbered wagon is shown. This procedure is of interest in the light of trials which have taken place on British Railways of systems for recording the numbers of wagons automatically as they pass a selected point, such as the

entrance to a yard. The two methods demonstrated have both involved the fitting to the wagon axleboxes of small devices carrying the wagon number expressed in binary code digits. One system scans the code with a light beam and detects the response with photocells, while the other uses the technique of super high frequency transmission and echo signals. Now that the practicability of recording numbers by this means has been shown, the study of methods for storing this information and making it available when and where required forms a second and more complex task, which would be undertaken in the knowledge that successful solutions could revolutionise the present organisation for rolling stock control.

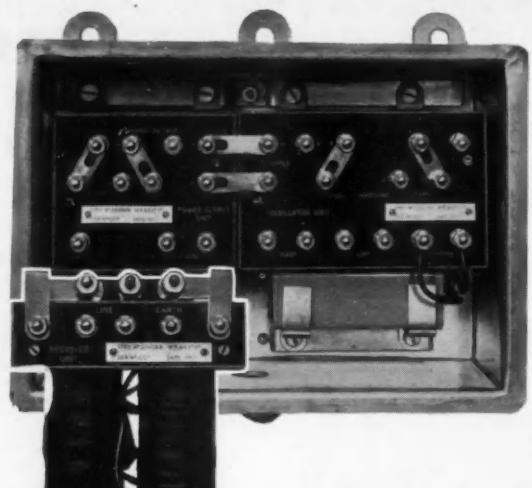
Signalling

Railway signalling is a field in which electronic devices have to satisfy exceptionally severe requirements of reliability and freedom from error before they are accepted as alternatives to existing equipment. The development of electric traction with single-phase current at 50 c/s has seen the introduction of signalling track circuits operating at higher frequencies, and in France frequencies between 300 and 1,000 c/s are being used, generated by thermionic valves or transistors. Elsewhere it is considered that satisfactory discrimination between traction and signalling currents can be obtained at frequencies in a much lower range, produced by motor-generators or by frequency-multiplying techniques using rectifiers.

There is, however, one track-circuiting requirement which can be met most satisfactorily by electronic means. The normal track circuit detects the presence of a train within a certain length of track of up to about a mile, but it is often necessary to know when a train has reached a particular position. Various forms of treadle are used for this purpose, but in a new method now finding application on main lines a very short track circuit is superimposed on one of normal length. The short, or "overlay," track circuit is fed with current from an oscillator working at some 10 kc/s. A relay connected across the track close to the feed point is normally energised from the oscillator output. With a normal d.c. or 50 c/s track circuit a train within about a mile of the relay acts as a shunt across its winding and causes it to be de-energised, but the impedance of the rails to the high frequency current of the "overlay" track circuit prevents the shunt from being effective until the train is in the immediate vicinity of the track circuit connections. The action of the "overlay" track circuit is quite independent of the ordinary track circuit within which it is situated, and there is no interruption of the continuity of the latter such as would occur if the short "overlay" section had to be defined in the usual manner by means of insulated rail joints.

There are many ways in which these short track circuits might be used, and they are not necessarily confined to signalling. They have been installed, for example, to control the operation of a carriage washing plant at St. Leonards, Southern Region, where they are arranged to start the machine as the vehicles are propelled towards it and to shut it down after the train has passed through. It might also be practicable to install "overlay" circuits in marshalling yard sidings to indicate when a line of stationary wagons has extended to certain lengths, this information being used in computing the speeds at which other wagons running into the same siding should leave the retarders.

Another application of "overlay" principles occurs on certain lines of London Transport, but differs in its mode of operation in that the relay is normally de-energised, the rail impedance being included in a link circuit between the oscillator and the relay. Reduction of this impedance by a train as it approaches and passes the track circuit connections allows energy to be transferred to the relay circuit.



Above: Westinghouse transistorised oscillator unit, with power supply unit, for "overlay" h.f. track circuit. The equipment is arranged for track-side mounting. Left: Receiver and relay unit of Westinghouse "overlay" track circuit equipment

Transistor Applications

A feature of the London Transport equipment is the use of transistors in the oscillator circuit. The transistor has advantages in its small size, low power requirements and moderate input impedance. The first use of transistor invertors to provide a.c. for fluorescent lighting from a railway carriage 24 V d.c. supply was made in the "Caledonian" express of the London Midland Region, British Railways, last summer.

A field for the application of transistors which is now opening up is in the remote control of signalling. Centralised control of signalling at numerous dispersed positions along a main line, usually single track, is already an established practice in many parts of the world under the name of C.T.C. (Centralised Traffic Control). Control impulses are sent out in coded groups which through the action of relays identify the position where the signalling operation is to take place and then initiate the desired changes of points and signals. After any such action a code is returned from the remote apparatus to confirm that this has responded correctly, and until this code has been received the next train of control impulses cannot be sent out. With this procedure it may take some 12 seconds to change a pair of points and alter the signal aspects accordingly. Considerable development is therefore taking place in electronic apparatus to accelerate the operation by taking over some of the functions of electromechanical relays.

The first installation of this type ordered by British Railways was for the Sittingbourne—Sheerness branch in the Southern Region. Cold cathode triodes will be the switching medium for opening control and indicating channels between the controlling signal box and the signalling apparatus in a continuously repeated cycle.

While a channel is open, the condition of the remote apparatus or the impulses dictated by the settings of the control keys will be transmitted in the form of pulses, or short bursts of oscillation with durations of a few milliseconds, generated by transistor oscillators.

A system of this kind enables the information on a signal box track diagram to be kept continuously up to date, any change being reproduced within a few seconds of its having taken place. If several control switches are moved simultaneously, all the apparatus concerned will operate with a similarly short delay, for control or indicating channels for every item are opened in a continuous sequence as the cold cathode triodes conduct in turn. Electronic remote control using transistors throughout is to be installed by the French National Railways on the Dôle—Vallorbe section of the main line to Switzerland and Italy, electrified in April last year.

When the control of signalling over long distances is centralised, the procedures necessary for the safe working of single lines are simplified and traffic moves faster. It is significant that in his presidential address to the Institution of Railway Signal Engineers this year Mr. J. F. H. Tyler said that the signal engineer had at his disposal to-day technical means which would enable more traffic to be moved over fewer tracks in greater safety than ever before.

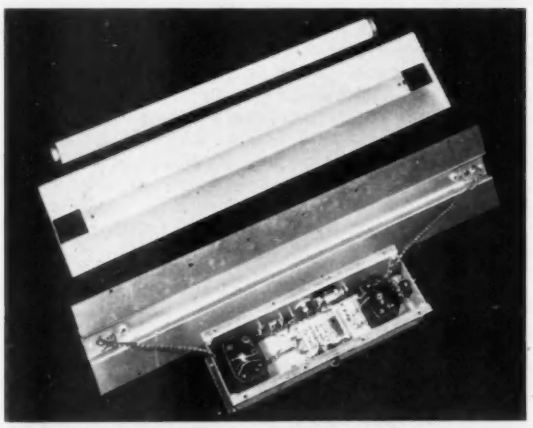
The type of electronic remote control mentioned above in connection with the Sheerness branch would be equally applicable to traction substations, being capable of transmitting meter readings in binary code form as well as the simpler control and return indications required for the remote operation of switchgear. Small installations of transistorised equipment have been made on the French National Railways for controlling single substations, which were previously attended, from a larger substation nearby, the attraction of the electronic equipment here being its compactness and low power demand rather than its speed of operation.

In electric locomotive practice the development of rectifier traction for the 50 c/s system has seen limited applications of grid control. In one Swiss-built equipment for a German mining railway locomotive the motor voltage is raised from zero to about 300 V by grid control, after which further increases up to the maximum motor voltage of 960 V are made in 28 steps by tap-changing on the transformer. The locomotive hauls trains of shale and overburden away from the mine workings for disposal, and is required to move the wagons at very low speed under a conveyor for loading. During loading operations the driver dismounts from the cab and controls the locomotive remotely by means of a frequency-modulated v.h.f. carrier from a position where he can watch all the wagons as they are brought into position. In this phase the speed is wholly dependent on grid control, the carrier being modulated according to the desired speed, and the locomotive receiver output appearing as a variable d.c. reference signal against which the rectifier output is adjusted. The grid control scheme also enables the rectifiers to operate as invertors when regenerative braking is required.

Apart from this somewhat specialised application of grid control, it may be mentioned that in a recent rectifier locomotive design for the Japanese National Railways nine out of 34 voltage steps on the controller are obtained by this system. It has been suggested elsewhere that the use of grid control to give stepless voltage variation in locomotives would be advantageous in providing an infinitely smooth increase of tractive effort at starting, after which ordinary tap changing could be used for normal running. Thus the usual objections of worsening of power factor and increase in harmonics which are advanced against the grid control principle would not be important.

Station Announcements

Electronics have been applied to railway communications mainly in ways which are not apparent to the traveller, although every user of the railways must be aware of the way in which the thermionic valve and the amplifier have revolutionised methods of conveying information to passengers at stations. There are now two station loudspeaker installations in this country in which announcements are broadcast from tape recordings. In the first of these schemes, installed at Stratford Station, Eastern Region, announcements are pre-selected by the signalman when he receives the description of an approaching train and are broadcast automatically as the train occupies certain track circuits. The second scheme came into operation recently at Gatwick Airport Station in the Southern Region and has the feature that announcements



Components of G.E.C. coach lighting fitting with invertor case open

G.E.C. fluorescent fitting incorporating transistor invertor

are broadcast in English and French. In this installation the selection and broadcast of an announcement follow immediately on the pressing of the appropriate push-button on a selector panel in one of the platform offices.

Loudspeakers and amplifiers are also used widely for giving instructions to staff in marshalling yards and large groups of sidings, although v.h.f. radio is also used for communication with locomotive drivers in these circumstances and has certain advantages when messages have to be transmitted to drivers in the enclosed cabs of diesel locomotives, where the noise level may be fairly high. Both in marshalling yards and at stations, portable loudspeakers of the " loud hailer " type, incorporating their own battery-operated transistor amplifiers, are now in use.

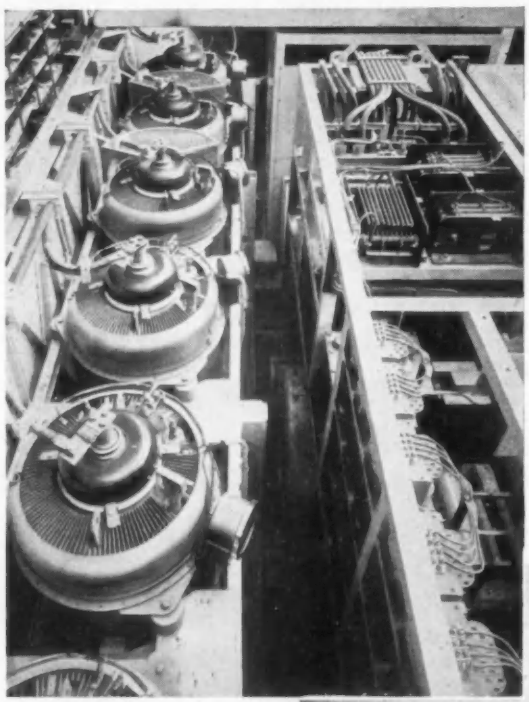
Television Equipment

Closed circuit television has been installed at Thornton Yard, Fife (mentioned earlier) to provide the yardmaster in his office with a view of all parts of the sidings outside the range of his direct vision, extending as far as the signal box at the western entrance to the sidings from the running lines. The closed circuit system has also been used for entertainment purposes in a Scottish Region excursion train. Ordinary broadcast reception is provided in certain trains of the Western and London Midland Regions which make day tours of scenic areas in the holiday season and are in some cases available for party hire at other times in the year.

The more advanced forms of electronic telecommunications equipment are found in the railways' own multi-channel carrier frequency telephone and voice-frequency networks. A new step for the railways in this field has been the decision to provide a micro-wave radio link to supplement existing facilities between York and Newcastle, connections with line circuits being made at the terminals. The trend in Post Office work towards electronic switching at exchanges, and associated developments such as trunk dialling, is also likely to be seen in the railways' own circuits in the future.

Applications of v.h.f. radio now familiar in the commercial field find their place in railway practice where appropriate, as in the control of parcel motor-vans introduced in the Aberdeen area this year. Radio communication with moving trains continues to be investigated on British Railways, where the most recent experiments to be announced have taken place in the North Eastern Region with the primary purpose of testing the possibility of maintaining contact with snow ploughs working in winter on the exposed line over Stainmore summit near Kirkby Stephen. The requirement for direct telephone contact with drivers is one which may become of more importance in some parts of the world as a by-product of other trends. In France, for example, an inductive telephony link is being provided on the overhead electrification structures of the Dôle-Vallorbe line where, as noted earlier, remote control of signalling over long single-track sections is to be adopted. An inductive link was used by the New York, New Haven and Hartford Railroad in 1955 for demonstrating the remote control of an electric motor coach, but in a similar demonstration given a few months previously with an electric locomotive in France the control signals had been transmitted by v.h.f. radio.

Neither of the tests referred to was aimed at demonstrating the practicability of operating railways with " driverless " trains (although shunting locomotives are controlled by radio at certain yards in France and the U.S.A.), but both were arranged to show the reliability in unusual circumstances of various types of electronic equipment. In the American experiment, for example, the automatic train control equipment in the motor coach, which enabled signal aspects to be obeyed in the absence of a driver, was of a new type in which transistors had



Above: Interior of locomotive for German mining railway showing the Brown-Boveri grid-controlled rectifiers on left

Right: German mining railway locomotive equipped with Brown-Boveri grid-controlled rectifiers

replaced thermionic valves for detecting and amplifying the coded signalling currents picked up from the rails.

Computers

Some of the most fundamental changes in railway methods which are likely to stem from the applications of electronics are those based on the use of computing equipment. British Railways were the first railway system in Western Europe to use computers for office work, the initial installations of computers at Swindon and Paddington for paybill compilation having been completed in the summer of 1957. They were preceded by an electronic multiplying punch introduced in 1955 at Crewe for routine calculations in the works accountant's office.

The extended use of computing equipment is foreseen both for conventional office work and for integrating information from many sources in order to provide data which cannot be made available by other methods. It is recognised that some of the most valuable applications of computers are not to jobs which could be performed more laboriously by office or technical staff, but to those which could not be undertaken at all without their aid.

On the other hand, the special circumstances of railway modernisation in many parts of the world, with the accompanying change-over to electric and diesel-electric power, have given great importance to computers as a means for obtaining rapidly the information on locomotive performance in given conditions which otherwise requires fairly lengthy calculation. Such computers need not be electronic, although electronic circuits are usually incorporated for various functions, as for the curve followers in the locomotive performance computer described in the *Electrical Review* of 18th April, 1958. The prototype illustrated in that article is now in service in the chief electrical engineer's office, British Railways Central Staff, at Marylebone, and other versions with various small modifications have been adopted by the traction industry. Such devices do not diminish the need for experience in making the first selection of suitable traction characteristics for a particular duty, but by greatly accelerating the investigation of various possibilities they help to ensure that specification requirements are met in the most satisfactory way possible.

The electronic computers of two makers are being used in a study of the scope and economics of computing equipment in timetable revision. This work is fundamentally an exercise in logic, and is being carried out by expressing in the form of a computer problem the many technical factors which are taken into account by a district control officer in finding a path for a relief train or other out-of-course working which has to be arranged at short notice. Another computer application might be to work out interlocking tables for railway signalling. This work calls for a high degree of specialised experience in considering all the requirements which must be satisfied before a particular signalling operation may take place, and in checking that no possible fault or failure, singly or in combination, could lead to conditions in which a collision might result. Not only is the available experience of this kind in heavy demand already, but the number and scale of new power signalling installations at home and overseas will increase the calls upon it to a greater degree than can be offset rapidly by training and recruitment. As an ultimate goal, it could be envisaged that the computer itself might replace conventional interlocking circuits, each signalling requirement fed into it being dealt with as it arises and the " answer " being given in a form which would control the signalling apparatus directly.

Pye television control unit in operation at Thornton marshalling yard, Scottish Region, British Railways

The " memory " characteristic of a computer might be a useful aid to seat reservation procedure at stations and offices by storing information on the seats of every train with reservation facilities to be operated in a given timetable period. It has been suggested that equipment could be designed which would enable the inquiry office clerk to show an illuminated diagram of any such train for a specified date, with the seats already reserved and those still free clearly indicated. After the prospective traveller had selected the seats required, they would appear as reserved on the next occasion the same train plan was shown. The same computer would be able to prepare train make-up lists and transmit them to the carriage sheds to enable reserved seats to be labelled before trains were dispatched to the terminus. Provision might also be made for a limited number of direct circuits between the terminal inquiry office and the principal town offices, so that callers at the latter could be issued with reservation tickets on the spot.

This brief review of electronics in the service of the railways has been confined to applications bearing directly on the day-to-day business of transport and has therefore omitted the types of electronic equipment used in research and technical investigations of many kinds. At this stage, also, it has been necessary to refer as much to possibilities as to established practice. This is symptomatic of the present state of development of electronics in the railway industry, when the study of technical and economic advantages to be gained from electronic science is often as important a part of a development project as the design of the apparatus itself.

Diesel-electric shunting locomotive under remote radio control in the marshalling yard at Achères, French National Railways

Domestic Appliance Production

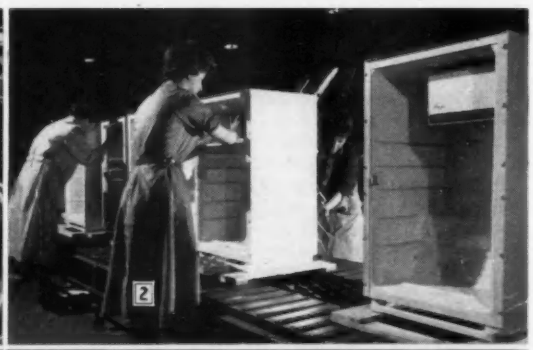
DESIGN, MANUFACTURE AND MARKETING

A VISIT last week to the Liverpool works of the English Electric Co., Ltd., enabled us not only to see how the company's domestic appliances are made but also to learn how the business is organised. The works has over 300,000 sq ft of manufacturing space in the extensive group of factories at Liverpool; it produces cookers and boiling plates, refrigerators, washing machines, tumbler dryers, food mixers, plate warmers and fractional h.p. motors.

Before touring the works we attended a conference at which Mr. H. C. Timewell, manager, Domestic Appliance Division, presided. Mr. Timewell said that last year the company produced appliances representing a load of 400 MW and about 2,500 people were engaged in this side of the English Electric Company's activities. By means of a chart he showed the tremendous influence of the Government's changes in purchase tax and hire-purchase policy which made it difficult to plan ahead. Nevertheless he expressed his confidence in the future of the appliance industry.

Mr. A. M. Parkinson, the sales manager, explained the marketing arrangements in Great Britain for the company's appliances. There are nine areas, each taking in the territory of two Electricity Boards, and each with its own manager. Sales are made direct to the retail organisations and the Division has demonstration teams which help the retailers to sell the appliances to the public. Area managers work to " targets " and in this way the Division has an idea of what to produce. In its transactions the Division observes the Fair Trading Policy. There is an important export trade and visits are regularly made to overseas markets to keep in touch with customers and study foreign manufacturers' ideas.

Market research and statistical methods were explained



1. Cooker, washing machine and refrigerator parts going through the enamelling plant. 2. "Slimline" refrigerators being fitted with evaporator assembly and sealed compressor unit. 3. Fitting automatic and ringer timer units to the facia panels of Model 2031 cookers. 4. Final tests on automatic tumbler dryers. 5. Heated washing machines leaving the production line

by Mr. K. G. Miller, manager, market research unit. Mr. T. Davidson spoke on the complicated subject of design for construction, operation and appearance and demonstrated his points with actual appliances. Finally Mr. H. Watson, production manager, briefly explained the works layout and operation.

Going into the works we were first shown the making of " Vee-Line " boiling plates which fit all cookers conforming to the E.D.A. specification. The elements are of the metal tube magnesium oxide filled type. After the insertion of the automatically-produced coiled-wire elements the circular tubes are filled and then given a square configuration. They are next coiled and flattened so that they provide an increased contact area. On another line the connector boxes are made up and are subsequently assembled with the rings and reflector plates.

In the afternoon we made a general tour of the works. Heavy materials, mainly steel sheets, are brought into one end and are unloaded and dealt with by guillotines which cut the sheets to convenient sizes. From the guillotines the sheets pass to the appropriate presses for shaping into the bodies of the various appliances.

By means of overhead conveyors the pressings are carried to various positions for processing and enamelling. There are two enamelling sections dealing respectively with high temperature parts, e.g., cooker hobs (vitreous) and low-temperature parts such as refrigerator bodies (synthetic). Great attention is paid to the constituency and consistency of the enamels and to the baking and drying of the finishes. The drying tunnels in the synthetic enamel shop are built in the roof recesses to economise in space. In other parts of the works heavy and light diecast parts are produced and there are plating shops.

A feature of the refrigerator processing department is a fully-automatic vacuum pumping and charging plant where a compressor is charged with oil and refrigerant in less than a minute. In a temperature- and humidity-controlled room performance tests are made, hundreds of complete units being carried through it on a conveyor before passing to a noise-testing compartment.

Each assembly line feeds into the packing area at the further end of the factory where the various products are put into cartons and carried away by the company's vans for delivery to all parts of the United Kingdom. The dispatch of export orders is facilitated by the comparatively short distance to the Liverpool docks.

Aiding production and marketing there are appliance engineering and design departments, development laboratories, model shops, a home economics laboratory for the practical testing of prototypes and production models, jig and tool design office, drawing offices, and a market research and statistics unit.

Before leaving the works we were conducted through the service department by Mr. C. E. Heap, the service manager. Apart from accommodating a vast quantity of spares for all the company's domestic products, the department is the administrative centre for the Domestic Appliance Division's " field service " which operates from many points throughout the country. Training is provided for field personnel working with the company or attached to dealers' staffs.

One point is worthy of mention in concluding these notes. Mr. Timewell assured us that all the appliances being produced in the works were already sold.

NEW BOOKS

Water Power Engineering. By Rolt Hammond. Pp. 302; 73 figs. Heywood & Co., Ltd., 9, Kingsway, London, W.C.2. Price 50s.

In recent years, hydro-electric generation has been receiving more attention since water power with pumped storage is the most economical way of providing the peak capacity to supplement nuclear power. The introduction of axial or tubular turbines will enable development of tidal and low-head projects to be carried out economically. Mr. Hammond reviews recent progress in hydro-electric engineering and his book comes at an opportune time. Amongst the few books written on the subject, this volume provides both the student and experienced engineer with the most comprehensive account of all the main aspects of water power so far published in one volume.

The full title of the book is " Water Power Engineering and Some Electrical Problems." The chapter on these problems has been approached from the point of view of a civil engineer who is more interested, for example, in the transmission lines than the electrical control arrangements. Apart from this chapter, the author covers his subject in three sections: turbine design, description of installed schemes and tidal power. This is, of course, the most logical method, since hydro-electric schemes cannot be generalised in the same way as, for example, thermal power stations. Each scheme has its own problems and is completely different from any other.

Although the author is a civil engineer, he covers both mechanical and electrical aspects and there is little reference to pure civil engineering. This book is, therefore, one of the few that justify the publishers' cliché that " it should be in the hands of all who are connected with water power engineering." More than with any other branch of engineering, it is essential that the specialist engineer shall have a good knowledge of other technologies connected with hydro-electric works.—T.C.

Railway Signalling Systems. By J. R. Day and B. K. Cooper. Pp. 144; figs. Frederick Muller, Ltd., Ludgate House, 110, Fleet Street, London, E.C.4. Price 9s 6d.

This book describes the development of railway signalling in this country from the days of " policemen " with flags, baskets on poles, and even lights in windows, to modern power-operated installations. Diagrams and photographs are used to explain constructional details of signals and associated apparatus, and the operation of a typical modern signal box is described. A chapter is devoted to track circuits and the various forms of relays employed, and a further chapter covers the growth of automatic train control.

BOOKS RECEIVED

Higher Electrical Engineering. By J. Shepherd, A. H. Morton and L. F. Spence. Pp. 566; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 40s.

Technisch-wissenschaftliche Abhandlungen der Osram-Gesellschaft. Pp. 408; figs. Springer-Verlag, Reichpietschafen 20, Berlin, W.35. Price DM 42.50.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has reappointed **Col. E. G. Angus,** C.B.E., M.C., D.L., Corbridge, Northumberland, **Mr. J. Bowman,** O.B.E., J.P., Gateshead, and **Col. R. Mould-Graham,** O.B.E., M.C., D.L., J.P., F.C.A., Newcastle-on-Tyne, as part-time members of the North Eastern Electricity Board.

Viscount Falmouth, Companion I.E.E., M.I.Mech.E., Chelsea, **Alderman E. Simms,** Brighton, and **Mr. H. F. Carpenter,** C.B.E., F.C.I.S., F.S.A.A., West Chiltington Common, Pulborough, Sussex, have been reappointed part-time members of the South Eastern Electricity Board, and **Mr. L. Parsons,** Haverfordwest, has been reappointed a part-time member of the South Wales Electricity Board.

Mr. C. H. Chaplain, Associate I.E.E., manager of the Publicity Department of the British Thomson-Houston Co., Ltd., has retired after nearly forty-

Mr. C. H. Chaplain

Mr. H. G. Harlow

seven years' service with the company. He is succeeded by **Mr. H. G. Harlow,** B.Sc., M.I.E.E., who has been manager of the B.T.H. Newcastle district office since 1955.

Mr. Chaplain went to Rugby in 1912 to join the staff of the B.T.H. switchgear drawing office after a short period with British Westinghouse (now Metropolitan-Vickers Electrical Co., Ltd.) at Trafford Park, Manchester. This followed an apprenticeship with Siemens Bros. Dynamo Works, Ltd. (now English Electric), at Stafford. In 1913, when the Switchgear Division was transferred to Willesden, Mr. Chaplain joined the newly formed Publication (now Publicity) Department, of which he became manager in 1948. In this position he controlled all publicity in connection with electric power equipment made by the B.T.H. Co. He has served on many committees, including the B.E.A.M.A. Publicity Committee, of which he was chairman from 1952 to 1954. He did a great deal of work in connection with the electrical and allied stand organised by B.E.A.M.A. at last year's Brussels Fair. He has also served on the Arts Advisory Committee of the Rugby College of Technology and Arts. In the 1914-18 war he served in the Royal Engineers and was mentioned in dispatches.

Mr. Harlow received his education at the Merchant Venturers' School, Bristol, and Bristol University, where he graduated in electrical engineering. During the 1914-18 war he served in the Royal Engineers. He joined the B.T.H. Co. in 1920 and after holding various positions became manager, Leeds District, in 1948.

Glover & Main, Ltd., announce that following the recent retirement of Col. W. R. Glover, C.M.G., D.S.O., T.D., chairman of the group since 1949, **Mr. P. D. M. Aird,** T.D., has been appointed chairman of Glover & Main, Ltd., and the principal associated trading companies, R. & A. Main, Ltd., Main Water Heaters, Ltd., and Thomas Glover & Co., Ltd.

Mr. A. J. Ford has been appointed general manager of H. Herrmann, Ltd., and subsidiary companies, F. H. Marshall & Co., Ltd., and Evansville Cabinet Co., Ltd. **Mr. H. G. Rook** has been appointed sales manager of Evansville Cabinet Co., Ltd.

Sir Gordon Russell, C.B.E., M.C., has decided to retire from the directorship of the Council of Industrial Design on 31st December this year, when he will be sixty-seven years of age. The Council has appointed **Mr. Paul Reilly,** deputy director since 1954, to succeed Sir Gordon on 1st January, 1960.

Mr. D. R. Poore has been appointed an additional director of Aron Electricity Meter, Ltd.

Mr. D. Crotch has joined the Scottish area offices of the Electric Construction Co., Ltd., at Bushbury House, 5, Woodlands Terrace, Glasgow, C.3, as assistant plant sales engineer. He served his apprenticeship at the Bradford works of the English Electric Co., Ltd., and had been at the Glasgow branch of that company since 1949.

Mr. W. Armour has joined the Scottish area office of E.C.C. (Moulded Breakers), Ltd., at 5, Woodlands

Mr. D. Crotch

Mr. W. Armour

Terrace, Glasgow, C.3, to be responsible for the promotion of the sale of a complete range of moulded breakers from 5 to 800 A. Since May last he had been manager of the "Alux" Division of Veritys, Ltd.

Sir Stanley J. Harley, B.Sc., M.I.Mech.E., M.I.Prod.E., chairman and managing director of the Coventry Gauge & Tool Co., Ltd., has been elected president of the Gauge and Tool Makers' Association for the current year. The chairman is **Mr. G. P. Barrott,** M.I.Prod.E., managing director of Precision Grinding, Ltd.

The **Hon. J. Kenneth Weir,** C.B.E., chairman of G. & J. Weir Holdings, Ltd., and G. & J. Weir, Ltd., Glasgow, has been elected a director of the International Nickel Company of Canada, Ltd., and a member of its advisory committee.

Mr. G. S. Bingham, M.I.Mech.E., M.I.Loco.E., M.Inst.T., mechanical engineer (works—railways), London Transport, has been appointed mechanical engineer (works and contracts) and **Mr. E. P. Lumley,** A.M.I.E.E., M.I.Loco.E., divisional

At the annual dinner of the Ipswich and District Electrical Association (reported in our last issue). Left to right: Mr. H. C. Waters (president, I.D.E.A.); Mr. J. O. Knowles (chairman, B.E.A.M.A.); the Mayor of Ipswich; Mr. W. J. Bird (director, G.E.C.); Mr. A. White (chairman, I.D.E.A.); and Ald. W. J. Bennett (chairman, Eastern Electricity Consultative Council)

depot engineer "B" (railways), has been appointed assistant mechanical engineer (works).

Mr. C. S. Youatt has relinquished his position as deputy chairman of Rhodes, Brydon & Youatt, Ltd., after forty-three years' service with the company, but continues as a director. **Mr. A. H. Parkes,** who has been a director of the company for over ten years and is deputy chairman and managing director of Small & Parkes, Ltd., has been appointed deputy chairman of Rhodes, Brydon & Youatt. **Mr. R. L. Furnival** has resigned from the board of Furnival & Co., Ltd., a subsidiary of Rhodes, Brydon & Youatt, Ltd. **Mr. H. Aston** has been elected to the board of Furnival & Co., Ltd., and will take up the appointment of chief engineer to both companies on 2nd March.

Mr. C. J. Harbud has been appointed district commercial engineer in the new Taunton District of the South Western Electricity Board as from 1st April next.

The Ministry of Supply announces that **Mr. H. E. Drew** has been appointed Director of Electronics Production (Air) in succession to **Mr. R. E. Sainsbury** who is attending the 1959 course at the Imperial Defence College.

Mr. A. T. Crawford, B.Sc.(Hons.), M.I.E.E., has been appointed manager, Home Contracts Department, of A. Reyrolle & Co., Ltd. Mr. Crawford was educated at the Royal Grammar School and Armstrong College, Newcastle-upon-Tyne, and received his training with A. Reyrolle & Co. He has held the successive positions of contracts engineer, district engineer (southern area), and senior contracts engineer with special responsibilities, and he was appointed assistant contracts manager (home) in 1951. Mr. Crawford served as chairman of the North-Eastern Students' Section of the I.E.E. in 1939-40, was hon. secretary of the North-Eastern Centre from 1951 to 1956, and is the present chairman of the Centre. He was also a member of the I.E.E. Council from 1953 to 1956. He serves on committees associated with the Northern Advisory Council for Further Education and Rutherford College of Technology, and on B.E.A.M.A. committees on publicity, and education and training.

Mr. A. T. Crawford

The Telegraph Construction & Maintenance Co., Ltd., announce that **Mr. D. W. Aldridge** and **Mr. W. C. Handley,** directors of British Insulated Callender's Cables, Ltd., have been appointed to the board of the Telegraph Construction & Maintenance Co., Ltd., and **Mr. W. F. Randall,** managing director of the Telcon Metals Group, has been elected deputy chairman. **Major H. Denison-Pender, Mr. J. Innes** and **Dr. E. W. Smith** have retired from the board.

Mr. D. W. Aldridge

Mr. W. C. Handley

Mr. W. F. Randall

Sir John Dean

Sir John Dean, chairman of the Telegraph Construction & Maintenance Co., Ltd., has been appointed a director of British Insulated Callender's Cables, Ltd.

A central department to be responsible for the publicity activities of all companies in the Radiation Group has been formed, and the following appointments have been made:—General publicity manager, Radiation, Ltd., **Mr. A. H. Edney.** Publicity managers, Electrical Division of Radiation, Ltd.: Parnall Products, **Mr. J. T. Barton;** Jackson Products, **Mr. K. H. Foulds.** Manager, Central Printing Department, **Mr. R. T. Puttock.**

Mr. G. Beesley has joined Ranco, Ltd., Tannochside, Uddingston, Glasgow, in a technical sales capacity in the Electrical Motor and Relay Department. He was formerly with the Metropolitan-Vickers Electrical Co., Ltd., where he was in charge of fractional h.p. motor sales in the London area.

Mr. A. E. Gregg, Assoc.M.C.T., Associate I.E.E., has been appointed general manager of F. & A. Parkinson, Ltd., Guiseley, one of the companies in the Crompton Parkinson group. Mr. Gregg joined the company in 1936, and was formerly product manager for motors at Guiseley, a position he took up in 1952 after a period as assistant product manager. He was also general manager of the Overseas Works Division. He has twice been a member of the junior board and was chairman on both occasions.

The new product manager for Guiseley motors is **Mr. J. C. Mansfield,** B.A., who joined the company in 1957 and has been assistant product manager. He is at present serving on the junior board.

Mr. G. R. Higgs, B.Sc., M.I.E.E., M.I.Loco.E., has been appointed chief engineer, Traction Projects Department of the Metropolitan-Vickers Electrical Co., Ltd., in succession to **Mr. F. Whyman,** who will in future devote his full time to his duties as chief engineer, Traction Division. **Mr. J. Beasley,** B.Sc.(Hons.), A.M.I.E.E., A.M.Inst.T., is appointed assistant chief engineer, Traction Control Department, succeeding **Mr. A. D. Ferguson,** who is appointed consulting engineer, Traction Control Department. **Mr. J. L. Russell,** Assoc. M.C.T., A.M.I.E.E., becomes chief engineer, Railway Signals Department, and the responsibility for this department is relinquished by **Mr. W. T. Gray,** chief engineer, Traction Control Department.

Mr. Higgs joined the Metropolitan-Vickers Electrical Co. in 1920 as a college apprentice. Following his training he had eight years' experience on the erection and commissioning of electric locomotives on overseas contracts. His subsequent work, apart from three years on gas turbine work during the war, has been on the design of electric and diesel-electric locomotives and trains. He was appointed

Inaugural meeting of the South Western Centre of the British Lighting Council at Plymouth. (Left to right): Mr. R. L. C. Tate, Mr. W. J. G. Guscott (assistant chief commercial officer, South Western Electricity Board), Mr. H. J. W. Stirling (city architect, Plymouth), Mr. C. J. W. Scott (British Lighting Council) and Mr. R. Hazell (S.W. resident engineer, British Lighting Council)

Mr. G. R. Higgs

Mr. J. Beasley

Mr. J. L. Russell

assistant chief engineer, Traction Projects Department in 1950.

Mr. Beasley joined Metropolitan-Vickers in 1944 as a college apprentice. On completion of his training he joined the Traction Control Engineering Department, where he has been a section leader since 1950.

Mr. Russell joined M-V in 1936 as an apprentice and after a period in the Plant Department drawing office he joined the Railway Signals Department as a junior engineer. In 1947 he transferred to the Electronic Control Engineering Department, where he became section leader, special contracts, in 1949. In 1955 he was appointed assistant chief engineer, special applications division, Electronics Engineering Department.

Mr. R. Baden Hellard, who writes on "Electrical Manufacturers and Building Costs" (page 354), is the son of an electrical engineer. He was educated in Cornwall and at the Polytechnic School of Architecture. He has worked in local government and is now in a private practice which he started five years ago, and which is as much engaged in consulting work with manufacturers in the development of new products and materials, as in general architectural practice.

Mr. R. B. Hellard

A member of the R.I.B.A. Cost Research Committee since its formation, he has been its chairman for the last twelve months and represents his Institute on the R.I.C.S. Cost Research Panel. During military service he broadcast many times as a Forces sports commentator, and has since spoken on architectural topics in the B.B.C. service. He tells us that he both works and lives in buildings heated by electric storage methods.

Mr. R. J. Green has left Norlond Press and joined Technograph Printed Circuits, Ltd., as publicity officer and personal assistant to the general manager.

Mr. R. W. Stobbs, F.R.I.C., F.I.M., has been appointed general manager of Preformations, Ltd., Cheney Manor, Swindon, the company recently formed by the Plessey Co., Ltd., and the Arnold Engineering Co., of Illinois, for the manufacture of "Magloy" permanent magnets. Mr. Stobbs joined the Plessey Co. five years ago as principal metallurgist at its Ilford factory. Previously he was for three years chief research metallurgist with the foundry division of David Brown Industries, Ltd., before which he was with the Ford Motor Co.

Mr. P. A. Nutkins has been appointed assistant sales manager of the Lamps and Lighting Division of Siemens Edison Swan, Ltd. He joined the Lamp Department of the former Siemens Electric Lamps & Supplies, Ltd., in 1947 after commissioned service in the Royal Tank Regiment.

The annual dinner of the **J. & P. Sports Club** was held in the Victoria Works Canteen on 7th February. Mr. G. T. W. Whitehead, works director of Johnson & Phillips, Ltd., proposed the toast to the Club and Mr. Lock (Club chairman), in reply, said that the Club had a membership of 2,000. Mr. R. Farley (captain of the Juno Rugby F.C.) proposed the toast of the guests and Mr. Madden, league secretary of the L.B.H. F.A. replied. The dinner was followed by the presentation of medals and cups won during the preceding season, after which there was a cabaret show.

Mr. A. J. S. Brown, a director of Stone-Platt Industries, Ltd., and joint managing director of J. Stone & Co. (Holdings), Ltd., left by air on 4th February to visit the Stone group's companies and associates in India, Australia and the United States. He will leave New York on his return journey in the *Queen Elizabeth* on 18th March.

At a dance held by **M.K. Electric, Ltd.,** on 30th January gold watches were presented to five long-service employees, making the total number who have received long-service awards sixty-one. Mr. C. L. Arnold, M.I.E.E., founder director, congratulated and thanked each employee and the presentation of the awards was made by Mrs. Arnold. The function, held at the Assembly Hall, Walthamstow, marked the 40th anniversary of the founding of M.K. Electric.

Mr. C. L. Arnold looks on as Mrs. Arnold presents a long-service award to Mr. E. S. Sale at a dance held to commemorate the 40th anniversary of the founding of M.K. Electric

Mr. J. B. Hassett has retired from the joint managing directorship of Hassett & Harper, Ltd., Birmingham, but remains on the board as chairman of the company. On 13th February a dinner was held in his honour at which a camera and projector screen were presented to him by Mr. A. B. Bulmer, an employee, on behalf of the 120 employees who attended the dinner.

Mr. A. W. S. Dyson has been appointed sales manager of the B.E.C. Lighting Co., Luton, Beds., manufacturers of fluorescent lighting fittings. Before joining the company, Mr. Dyson was for nearly twenty years North West London and Home Counties representative of the Midland Electric Manufacturing Co., Ltd., and earlier years were spent as Midland representative of M.K. Electric, Ltd.

Mr. A. W. S. Dyson

Mr. R. L. Thomas, M.Eng.(Zurich), has been appointed general manager of British Brown-Boveri, Ltd., and will be in charge of the activities of this company following the death of the managing director, Mr. H. Oswald. **Mr. R. H. Coates,** A.M.I.E.E., manager of the electrical section, will act as his deputy.

E. G. Phillips, Son & Partners, Nottingham, consulting engineers, have taken **Mr. F. F. Draper** and **Mr. F. Quail,** M.I.H.V.E., into partnership. Both these gentlemen have been on the staff for over thirty years.

Mr. P. Alsop has left E.M.I. Electronics, Ltd., where he has been employed during the past three years in an advisory capacity on the application of new techniques and processes, including printed circuitry and resin encapsulating for use in electronic equipment. He has joined Technograph Electronic Products, Ltd., where he will be responsible for the Technical Sales Division in the computer, guided weapons and airborne equipment fields.

The golden jubilee commemoration function of the **Illuminating Engineering Society** which we reported last week was linked to all the I.E.S. Centres in this country and to the one in Johannesburg, South Africa. The reception in Newcastle-upon-Tyne was completely satisfactory. The G.P.O. line was terminated by a matching transformer which was

Mr. H. Jones (left) with the chairman of the I.E.S. Newcastle-upon-Tyne Centre, Mr. H. Ainsworth

directly coupled to the input of a G.E.C. amplifier. Two G.E.C. loudspeakers provided adequate sound coverage for the 80 persons who were present. The Newcastle-upon-Tyne Centre chairman, Mr. H. Ainsworth, M.I.E.E., presided at the meeting and the only formal business was when he announced that Mr. H. Jones, A.M.I.E.E. (retired lecturer in electrical engineering at Rutherford College of Technology, Newcastle-upon-Tyne), was present representing those past chairmen of the Centre who were unable to attend.

Mr. J. Sim has been appointed general manager of Westool, Ltd., St. Helen's Auckland, Co. Durham. He received his engineering training with Vickers-Armstrongs, Ltd., and, until 1951, was manager of Vickers Eastern, Ltd., which sold and serviced Vickers group products in South East Asia, when he returned to England to become sales manager of Oliver Pell Control, Ltd., and the Varley Magnet Co., Woolwich.

Mr. J. Sim

Mr. J. E. Taylor, a technical sales engineer in the Commercial Department of Marconi Instruments, Ltd., has been seconded to the company's agents in India, Associated Instrument Manufacturers (India) Private, Ltd., where he will assist in the setting up and operating of a calibration centre in Delhi.

Mr. C. E. Walker has been appointed assistant sales manager of "His Master's Voice" Radio & Television Sales, Ltd., a position he will share jointly with **Mr. A. E. Lawson,** who also has the responsibility of sales promotion. Mr. Walker will continue to operate the territories which he covered as southern area manager.

The annual dinner and dance of the **I.E.E. Western Centre** will be held on 3rd April at the Grand Hotel, Bristol. Applications for tickets (£1 7s 6d for members and 10s for graduates and students for the dance only) should be made by 7th March to Mr. W. D. Morgan, hon. assistant secretary, "Green Lea," Farleigh, Backwell, Bristol.

A dinner-dance is being held by the **I.E.E. Southern Centre** on 10th April at the Bedford Hotel, Brighton. Applications for tickets (£1 10s for members and £1 for students) should be made by 23rd March to Mr. R. Summarsell, South Eastern Electricity Board.

Mr. S. Shrigley, B.A.(Com.), A.I.M.T.A., A.C.C.S., administrative officer, organisation and methods team, at the North Western Electricity Board's headquarters, has been appointed assistant chief accountant (accounts, estimates and banking), also at the Board's headquarters. Mr. Shrigley, who took up his duties on 16th February, succeeds the late Mr. N. G. Smith. Mr. Shrigley held several posts in the City Treasurer's Department of Manchester Corporation before being appointed accountant to the North Western Electricity Board's No. 7 Sub-Area based at Stockport on the nationalisation of the electricity supply industry. In 1954 he became secretary/accountant of the same Sub-Area. He was appointed administrative officer of the Board's organisation and methods team last September.

Poselco, Ltd., has appointed Mrs. M. K. Rutter (secretary) and Mr. E. W. Clark as directors of the company.

Mr. D. C. Lorkin, managing director of the **Lancashire Dynamo Group,** presented fifteen long service awards to employees of Dynamo & Motor Repairs, Ltd., at a luncheon held recently at Wembley Park.

Mr. K. E. Comport has retired from active duties with Brown Brothers, Ltd., following a long illness. He joined the company in 1933, in charge of sales at its Manchester branch and became manager at Bristol in 1935. Shortly after the end of the war he took up an appointment at head office and in 1950 became a general manager of the company and was elected to the board in 1953.

Mr. K. E. Comport

Presentations were made on 4th February in the canteen of **Aron Electricity Meter, Ltd.,** by Sir Edward Herbert, O.B.E. (chairman), to long-service employees. These included two with forty years' service and twenty-two with twenty-five years' service.

Mr. W. F. Stones, A.R.I.C., divisional chief chemist, North Eastern Division, Central Electricity Generating Board, has been appointed regional research officer to the North Eastern and Yorkshire Region of the Board.

Mr. J. F. Hancock has been appointed assistant superintendent, Maintenance Department, of the Metropolitan-Vickers Electrical Co., Ltd. Before joining Metropolitan-Vickers in 1958 he was with the Dayton Corporation, of Dayton, Ohio, and was responsible as plant engineer for the development and maintenance of their new factory in Scotland.

Mr. J. F. Hancock

OBITUARY

Signor L. Emanueli.—We regret to learn of the death in Italy on Monday last of Signor Luigi Emanueli, vice-president of the Pirelli Co. of Milan and a director of the Pirelli-General Cable Works, Ltd. He was in his seventy-sixth year. It was only last week that we reported the award to Signor Emanueli by the Council of the Institution of Electrical Engineers of the Faraday Medal. We then gave brief details of his career.

Dr. T. L. Eckersley.—We regret to report the death of Dr. Thomas Lydwell Eckersley, F.R.S., at the age of seventy-two. Dr. Eckersley was a leading figure in the radio world from its very early days. After education at Bedales School and London University he conducted research work at the National Physical Laboratory and at Trinity College and the Cavendish Laboratory, Cambridge. He served with the Royal Engineers in the Middle East during the 1914-18 war, being engaged in wireless work. Upon leaving the Army Dr. Eckersley joined the Marconi Co. and did some valuable work on aerials. Later research was into the propagation of electromagnetic waves, including high frequency waves, and into the ionosphere. These studies formed the subjects of notable I.E.E. and Royal Society papers. He was elected a Fellow of the Royal Society in 1938. The I.E.E. awarded him the Duddell Premium in 1922, 1927, 1929 and 1932, and the Kelvin Premium in 1940.

The late Dr. T. L. Eckersley

During the last war Dr. Eckersley was engaged on special work for the Air Ministry and he became chief scientific adviser to the Interservices Ionosphere Bureau, which involved much work in connection with the development of radar. In 1946 he was elected a Fellow of the American Institute of Radio Engineers and the

I.E.E. awarded him the Faraday Medal in 1951.

Dr. Eckersley retired from active work in 1946 on account of ill-health but continued to produce papers and articles on his special subjects.

Col. H. G. Fraser.—The death occurred on 12th February at the age of seventy-three of Col. Harold Gordon Fraser, M.C., T.D., M.I.E.E., who retired from the position of manager of the Newbury Sub-Area of the Southern Electricity Board in 1952. After education at the Manchester College of Technology, Col. Fraser served with the Stockport, Leigh, Blackburn and Wakefield undertakings. He held a commission in the infantry during the 1914-18 war and was awarded the M.C. for his part in the battle of the Somme in 1916. From 1920 to 1932 he was city electrical engineer of Wakefield and then went to Oxford in a similar capacity, remaining there until vesting day when he became manager of the Newbury Sub-Area.

Mr. Michael Burns, Dunleer, Co. Louth, Eire, who played a prominent part in the setting up and development of the A.E.T. electrical factory at Dunleer, has died at the age of eighty-two. He was a director of the company up to 1956, when A.E.T. was taken over by the G.E.C. as a subsidiary company.

Sir Owen Richardson.—The death occurred on 15th February of Sir Owen Richardson, F.R.S., who for twenty years was director of research in physics at King's College, London University, until his retirement in 1944. He was seventy-nine. Sir Owen Richardson was particularly noted for his work on the emission of electrons from hot bodies, of great importance in the development of the thermionic valve.

WILLS

Sir Louis Sterling, former chairman of Electric & Musical Industries, Ltd., who died on 2nd June last, left £667,250 gross (£599,920 net).

Mr. H. G. Campbell, chairman and managing director of the Benjamin Electric, Ltd., who died on 4th August last, left £125,618 gross (£111,256 net).

Mr. F. Johnston, M.I.E.E., formerly manager of the Electrical Department of Harland & Wolff, Ltd., Belfast, who died on 2nd March last, left personal estate in Great Britain and estate in Northern Ireland valued at £19,414.

Vera Norvick Memorial

Miss Mary George, Director of the Electrical Association for Women, has announced that a fund has been opened to establish a memorial to the late Miss Vera Norvick, who was for many years assistant secretary of the E.A.W. Miss George says that it is anticipated that many of Miss Norvick's friends will wish to contribute to the fund and donations should be sent to the Vera Norvick Memorial Fund, 25, Foubert's Place, London, W.1.

Restrictive Labour Practices

Electrical contracting in England and Wales is one of six industries stated in a report of the National Joint Advisory Council as having done nothing to deal with restrictive labour practices. The Council was told by the National Federated Electrical Association that it did not consider any purpose would be served by discussions with the Electrical Trades Union.

The Council is presided over by the Minister of Labour and it includes representatives of the British Employers' Confederation, the Trades Union Congress and the nationalised industries. Its report, entitled "Practices Impeding the Full and Efficient Use of Manpower" (H.M. Stationery Office, 1s), is the result of three years' work.

While recognising that there is often a very real difficulty in drawing the line between restrictive practices and justifiable measures to protect safety, health or standards of work, the Council considers that both restrictive practices and attitudes should be subjected to a new and searching examination to determine whether and to what extent they still correspond to the present needs of industry. The Council attempts to stimulate industries to embark on joint examination of such problems.

Some 190 industries were approached through their employers' organisations. More than seventy "minor" industries failed to co-operate, but the one hundred and twelve industries which did represented more than three-quarters of those in civilian employment. Sixty-four of these industries, covering 29 per cent of civilian employment, reported that they had no problems with regard to the efficient use of manpower. A further forty-two industries, covering 39 per cent of the workers, had set up or were setting up the appropriate machinery. These included cable manufacture, electricity supply and electrical contracting in Scotland. Though employing only 7 per cent of the workers, the remaining six industries (those that had been unable to undertake a joint examination) include some that "are of considerable importance to the country's future."

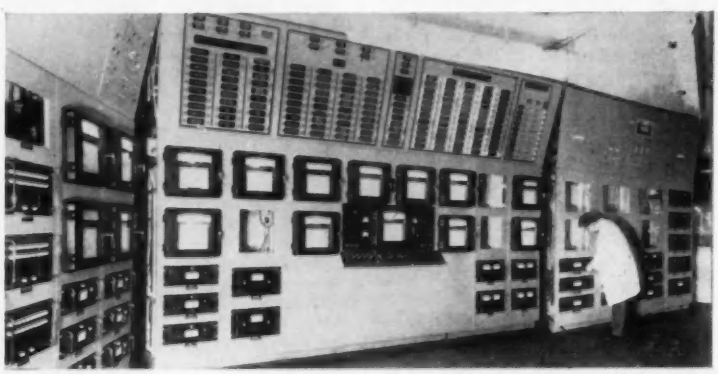
The Council considers that the unresolved difficulties holding up joint discussion in these industries are "a matter of legitimate public concern." A joint statement from the engineering industry recognising the existence of difficulties that require time and patience to solve is published as an appendix to the report.

The Council feels that some encouragement can be derived from the results of the inquiry but it recognises that much depends on the use to which joint machinery is put and the success that attends its operation.

Danish Nuclear Reactor

The Danish nuclear reactor now nearing completion at Riso, near Copenhagen, is a heavy-water moderated, materials-testing reactor. It is the third of its type to be built so far, the two previous examples being PLUTO and DMTR in Great Britain, and it is the largest materials-testing reactor to be exported from this country.

The nuclear instrumentation has now been completed, ahead of schedule, at the Ekco Electronics Laboratories, Southend, where on Monday last the Danish Ambassador inspected the equipment before it was dismantled for shipment and met the Mayor of Southend, Mr. E. K. Cole, chairman of Ekco, and Dr. Fisher, managing director of Head Wrightson Processes, Ltd., the contractors responsible for the reactor.



Instrumentation for the new Danish nuclear reactor undergoing final adjustment in the Ekco laboratories

PARLIAMENTARY REPORT

Amended Borrowing Powers

Government amendments have been tabled to the Electricity (Borrowing Powers) Bill to reduce the additional borrowing powers of the electricity authorities from £1,060 million to £475 million. The new limits are: Electricity Council £1,800 million (reduced from £2,300 million), North of Scotland Hydro-Electric Board £240 million (reduced from £300 million) and South of Scotland Board £110 million (reduced from £135 million). The Bill was to provide for borrowings for a period of six to seven years; the amendments mean in effect that the capital investment programmes of the Boards will be reviewed after a period of about four years. By means of an Order, the Minister of Power can provide that the Boards should be allowed to go up to the original limits named in the Bill, but such an Order would have to come before Parliament for approval.

It is understood that the amendments have been introduced because of the criticisms of Conservative backbenchers who asked the Minister to make the Boards more accountable to Parliament, and said they were prepared to vote against granting borrowing powers for such a long period ahead as six or seven years.

Nuclear Insurance Bill

When the Nuclear Installations (Licensing and Insurance) Bill was considered on second reading in the Commons last week, Sir Frank Soskice questioned whether a person who might suffer injury from gradual exposure to radiation would be able to claim under the terms of the Bill.

Mr. Arthur Palmer said that the Bill dealt with the effects of what might happen if something went wrong in the future rather than with efforts to prevent such occurrences from happening. He believed that safety should have been the Bill's primary objective. There was a case for setting up an independent statutory body—a nuclear safety council. In some circumstances if something went wrong, as the result of a leak in a reactor, the only way to ensure the safety and even the lives of the employees was for them to be withdrawn from the plant immediately.

Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, said there was no possibility of people being subjected to Strontium 90 unless there was a definite "occurrence" at a nuclear plant, but the Government would look into what Sir Frank Soskice had said about prolonged radiation where there was no specific occurrence. The Bill, in spite of what had been said, was a safety Bill, the primary purpose being not compensation but to give powers to the Minister to see that nuclear plants were operated in the best way that scientists and engineers could discover. Concerning the evacuation of personnel, referred to by Mr. Palmer, the Minister said that this was precisely one of the things which would be considered before a licence was granted.

The Bill was read a second time, without a division.

Nuclear Power Programme

Replying to Mr. Nabarro, Sir Ian Horobin said that it was not expected that the nuclear power programme up to the end of 1966 would require more than 12-14 stations. Four of these were under construction, at Bradwell, Berkeley and Hinkley Point in England and at Hunterston in Scotland; consent had been given for a further station at Trawsfynydd (Merioneth); and applications for consent to build stations at Dungeness (Kent) and Sizewell (Suffolk) had been submitted to the Minister. The electricity authorities were looking for further sites for stations in the current programme, and he could not say how many additional sites might be required before the end of 1965 for stations to be commissioned after 1966.

Power Station Extensions

Mr. Albert Roberts asked how many extensions of coal-fired power stations had been authorised.

Sir Ian Horobin said eleven new coal-fired power stations were now being built in England and Wales and thirteen existing coal-fired stations were being extended. For the future, the Central Electricity Generating Board planned to provide by the end of 1965 14 million kW of new capacity altogether and over half of this would be coal-fired.

New Kent Power Station

Sir Ian Horobin informed Mr. J. Arbuthnot that it was intended that the new power station at Richborough should be coal-fired so as to burn fuel from the pits in the East Kent coalfield.

Hire-Purchase Capital

Mr. George Darling asked whether the discussions between the electrical industry and the Government regarding the amount of capital to be authorised for hire-purchase had yet been completed, and with what results.

Sir Ian Horobin said he could not yet add to the statement made on 20th January by the Paymaster General.

Mr. Darling asked if the Minister was aware that the various Electricity Boards agreed willingly with the proposition that their hire-purchase terms should be in line with general commercial practice. He corrected a misleading statement made in a recent debate that the Yorkshire Electricity Board offered hire-purchase terms equivalent to a rate of interest of below 5 per cent. It was, in fact, about 8 per cent.

Sir Ian Horobin said he was glad to have support from the Labour benches for the principle, laid down by the Government, that broadly speaking the nationalised boards should conform to normal commercial practice. On rates of interest, mistakes were often made in calculations through confusing the interest charged on the initial advance and the equivalent interest on the reducing balance.

Lisbon Trade Fair

The Prime Minister informed Sir Leslie Plummer that the President of the Board of Trade would be present at the opening of the British Trade Fair to be held in Lisbon in May. He congratulated the F.B.I. in making arrangements for the Fair, and pointed out that our exports to Portugal in 1958 totalled £22,500,000.

Proposed Peking Exhibition

Mr. John Rodgers, Parliamentary Secretary, Board of Trade, told the Commons that the Federation of British Industries was hoping to stage an exhibition of British goods in Peking in the spring of 1960. The project—which had the support of the Government—had been held up because the Chinese had not yet given permission for the representatives of the organisers to go to Peking.

British Industry and European Free Trade

Making his first speech in the Commons after his election as the Conservative member for Morecambe and Lonsdale, Mr. Basil de Ferranti spoke in the debate on European Free Trade about the reasons which prompted France to back out of the negotiations in December after British Ministers had tried to find a way in which a wider free trade area could be associated with the Common Market, which came into operation on 1st January. One reason, he said, might have been the constitutional crisis in France. A second was that the French had not the slightest intention of allowing the United Kingdom into the "club" so that we, as well as Germany, could compete in their home market. "If this is true," he said, "it raises serious problems for British industry. I speak as one with an interest in, and day-to-day knowledge of, the electrical industry. If that is the reason it will be necessary for us as an industry, and, presumably necessary for other industries also, to take action to protect ourselves in third markets. Such action could possibly not be in the interests of the freedom of world trade and possibly not in the

interests of the freedom of German or French trade either."

If there was, or if there was not, to be a European Free Trade Area—he hoped there would be—inevitably British industry would face severe competition in third markets. This might mean that there would have to be certain rather uncomfortable attempts at co-operation between British firms in an attempt to rationalise production and to attain some economies of scale in order to do that. He hoped this would take place as smoothly as possible and that the Government would give assistance where possible.

Mr. Maudling, the Paymaster General, said that the Government had no proposal to make at the moment. They were discussing a *modus vivendi* with the French and were consulting some friendly countries about the next move. He promised again that the Government would continue to try to find some way of associating the trade of the rest of Europe with the trading arrangements of the Common Market countries.

Navigational Aids

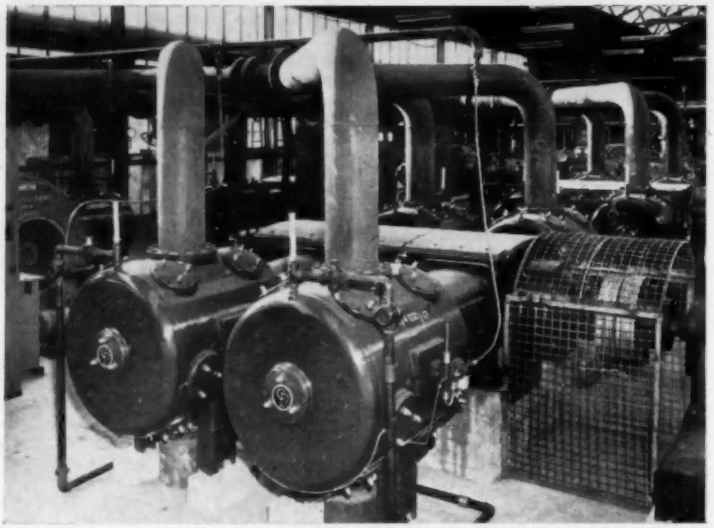
Mr. John Hall asked the Minister of Transport if he was aware that attempts were being made to prohibit the use of British navigational aids in aircraft and ships using airfields and ports outside the United Kingdom.

Mr. Watkinson said that where British aids were the best, the Government did everything to prove their merits and advocate their adoption. Recently special Comet flights had demonstrated the Decca air navigational system in London and Paris; these would be repeated in New York and Montreal, where the British delegation would strongly advocate its adoption as an international standard short-range air navigational aid at the International Civilian Aviation Organisation conference.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £237 5s 0d
Fire Refined 99·70%	ton £236 0s 0d
Fire Refined 99·50%	ton £235 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £268 0s 0d
H.C. wire and strip ..	ton £287 15s 0d
LEAD, English ..	ton £70 5s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £770 10s 0d
ZINC, G.O.B. Foreign	ton £74 5s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE Wire	lb 4s 1½d
PLATINUM	oz £21 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 25½d—25¾d



Consolidated Pneumatic compressor supplying air for the Clyde tunnel project

Compressed Air for Tunnel Project

THE electrically operated compressors installed at the site of the Glasgow Corporation's Clyde tunnel project have a capacity of 28,610 cu ft/min at 40 p.s.i. for tunnel pressurisation and 2,720 cu ft/min at 125 p.s.i. for the operation of power tools.

Ten Consolidated Pneumatic and three Alley MacLellan single-stage compressors supply the l.p. air and five Consolidated Pneumatic two-stage compressors provide the h.p. air, all being water cooled. The three Alley MacLellan units are driven by 400 b.h.p. 585 r.p.m. Bruce Peebles induction motors, and the Consolidated Pneumatic two cylinder units by Brush 325 b.h.p. synchronous shaft mounted motors. Two 650 b.h.p. Brush slip-ring motors drive the Consolidated Pneumatic type FE41 compressors, while the remaining low and high pressure units are also electrically operated, the motors used being by Brush, English Electric and Bruce Peebles.

Ancillary equipment in the compressor house includes three 270 kW Lister Blackstone EVS6 standby diesel alternator sets, a Lister 17½ kW FR4 emergency lighting set, and four 6in centrifugal pumps supplying cooling water, two of these being Sigmund GL6a 20 b.h.p. units and two Sykes S.P.B. 6in 30 b.h.p. units.

Emergency Lighting Contactor

IN our last issue we described the emergency lighting contactor type 2B made by E. N. Bray, Ltd., Control Gear Works, Britannia Road, Waltham Cross, Herts., but omitted to mention that it complies fully with requirements of B.S. 764 : 1954. This shaft type change-over contactor is equipped with contacts rated at 30 A up to 250 V a.c. or d.c. To clarify matters we should explain that the operating coil is fed from the normal lighting supply and this connects the lighting load to the upper contacts on the contactor. Should the supply fail, or drop to 60 per cent of the normal, the operating magnet releases and a combination of gravity and springs closes the lower contacts which connect the load to an alternative source of supply. When the normal supply recovers to at least 85 per cent the contactor automatically recloses and restores the load to this supply; a voltage relay controls this operation.

As the contactor is a three-pole unit it can be used to control three-phase emergency lighting at up to 30 A (provided neutral switching is not required). Alternatively it can be used as a normal changeover device for loads other than lighting at currents of up to 50 A.

Educational

A short residential course for works and plant engineers on steam generation and utilisation in industry will be held at Bristol University from 6th to 10th April next. Particulars can be obtained from the secretary of the Council for Further Education for the South West, 12, Lower Castle Street, Bristol, 1.

VIEWS on the NEWS

By REFLECTOR

SOME critical amusement was aroused when it was reported a week or two ago that the National Union of Mineworkers proposed to heat their new headquarters in London by means of oil. This was at a time when miners' leaders were protesting at the use of oil at some of the power stations of the Central Electricity Generating Board. As a result of the outcry the Union altered its mind and decided to use coal thereupon drawing a protest, in *The Times*, from the Medical Officer of Health for St. Pancras, which is shortly to be declared a smokeless area. He said that he had asked the Union for an assurance that only smokeless fuel would be burned and in a plant so contructed that there would be no emissions of smoke, grit or dust. It does not seem to have occurred to the Union that they should use electricity produced from the small coal of which there is a surplus and thus avoid all the trouble they are letting themselves in for.

* * *

While I do not unreservedly accept the claims of the Electricity Boards about the small proportional increase in electricity charges in the past few years, because I meet so many exceptions, there is no doubt that disgruntled consumers are apt to exaggerate. One of them recently said in a letter to the *Manchester Evening News* that whereas in 1950 he paid 16s 1d for 258 units, for the same quantity the price was now £2 2s 6d, about 164 per cent more. Taking this up, Mr. A. O. Johnson, chief commercial officer of the North Western Electricity Board, pointed out a flaw in the argument, which was that the writer had overlooked the standing charge in giving his 1950 figure. This, of course, rather invalidates the comparison. Mr. Johnson said that since 1950 the average cost of domestic electricity had risen from 1·12d to 1·482d, an increase of only 32 per cent.

* * *

Last Friday the B.B.C. Television Service presented an inquiry by Robert Reid into the causes, harmfulness and possible cures of "smog." The Manchester area was selected as the awful example and a dreadful tale was told. In dealing with remedies there were references to the use of smokeless fuel and gas (in one case a conversion from gas to oil) but I heard no mention at all of electricity. It requires a good deal of ingenuity to arrange a programme on this subject and entirely overlook the most effective means of getting rid of smog.

* * *

The home of the electric chair is the United States, but the latest refinements in this direction have nothing to do with penology. As reported by the *Financial Times*, a new chair produced in America is claimed to relieve tension and soothe the nerves of business executives. It has a built-in electric massage motor and heating element and if the "executive" is fatigued he can "turn the motor fully on to get a brisk stimulating massage with heat. If he is taut and over-stimulated, the motor can be switched to low speed to provide a gentle massage that 'calms and soothes.'" This, I suppose, involves much less trouble and takes up less time than a round of golf.

* * *

Attendance at annual dinners arranged by institutions and societies and their branches has given me an impression that the members look upon them as the events of the year and turn up in full force. Apparently this is not true of all such functions for in the report of one E.P.E.A. section in the *Electrical Power Engineer* the following passage appears:—

> "It has been decided not to hold an annual dinner this year. Support from members for this function has declined year by year and the section committee do not feel it is their duty to provide a dinner, however enjoyable, for their friends outside the Association. We have had all the old arguments again—about evening dress, about ticket prices, and dates that clash with other functions. Quite frankly, we do not feel we can compete with functions subsidised by the industry's sports and social clubs for their members and, in these circumstances, it is difficult to see how our dinner can ever be revived without a positive demand from members. The committee are giving consideration to a summer outing as an alternative."

Why not both? But really this note exposes what one felt were only minor grumbles instead of the tremendous trifles which they seem to be.

* * *

In the same issue of the *Electrical Power Engineer* another section reports:—

> "At this point the meeting centred its attention on the lamentable lack of lead from the . . . head office personnel. There was only one member of the technical staff in the section and he was out of benefit, and of the total of fourteen unpaid members, six were from head office."

Lack of "brass" rather than lead I should have thought. But what can be expected from unpaid members?

* * *

From the *Electrical Review* of 19th February, 1909:—

> "Mr. Robert Hammond has just returned from Constantinople, where he has been conferring with members of the Government, and speaks hopefully of Turkey as a field for British electrical enterprise. The one or two places that are lighted by electricity in Constantinople have obtained the machinery surreptitiously. The Pera Palace Hotel, for example, utterly failed to get an electrical generator through the Customs as long as it was described as a dynamo. So they telegraphed to Germany for another generator, which was taken to pieces and labelled as coffee machinery. This they had no difficulty in passing through the Customs, and they told the officials that the dynamo might be sent back, as they had found another way of making electricity. Under the new *régime* more enlightened views prevail, and Mr. Hammond believes that immense business is to be done in Turkey by the introduction of the telephone and electric traction."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Service Connections

WHILST the survey by Mr. E. H. Jesty in your issue of 13th February is a comprehensive one when dealing with the appropriate regulations, I was more than a little surprised to see that I.E.E. Regulation 207(G) was ignored.

The relevant section reads: "Cores of sheathed cables from which the sheath has been removed and non-sheathed cables at the termination of conduit or duct or trunking *shall be enclosed*" (my italics). This is a strict requirement of good installation practice and it is a little difficult to comprehend why Electricity Boards, who are mainly responsible for enforcing these regulations, do not apply it to their own meter connections.

The photograph of "a modern service connection" which accompanies the article glaringly ignores the procedure of enclosing the cable connections to the meters. It is hoped that Mr. Jesty, in his present capacity, will press the Boards to fit appropriate enclosures as an essential requirement.

"SWITCH-ON."

THE article of 13th February was interesting, but its photograph entitled "A modern service connection" does not illustrate good practice (as I understand the term). The picture showed a surprising amount of unenclosed v.i.r. cables—a condition which much diminishes the integrity and appearance of the service equipment. Various supply undertakings did much better years ago.

METER INSPECTOR.

13 A Socket Outlets

MY domestic use of 13 A socket outlets has not confirmed Mr. Cameron Brown's doubts (*Electrical Review*, 30th January), although I have used these outlets for more than four times the length of time he claims. I must, however, admit at once that I do not use 13 A adaptors—where required twin socket outlets cost less than a single socket and adaptor, while being neater and more efficient mechanically and electrically.

Mr. Cameron Brown claims that tilting of the plug spoils contact in the socket and also that contact with round-pin plugs is superior. To test these assertions I selected a specimen at random of a good type of 13 A plug and socket (M.K.) of 1952 manufacture, which had been in regular use but which I did not in any way clean up for the purpose. This was compared with a new 15 A plug and socket. The test consisted in measuring the voltage drop between the L and N sockets with 10 A flowing, after the plug, with the L and N terminals joined by the shortest possible length of 40/·0076 flex, had been inserted, the test being similarly repeated between the N and E terminals. For the 13 A arrangement the resistance was approximately 0·0075 ohm for L and N, and 0·0025 ohm for E and N, the extra 0·005 ohm being the resistance introduced by the fuse and holder. For the 15 A arrangement in each case the resistance was 0·002 ohm.

The 13 A plug could be withdrawn about 0·3 in without the resistance being appreciably altered and it increased only slightly just before the contacts were about to open. Large force applied parallel to the plug front, so tilting it, only brought out the earth pin by about 0·1in and the current pins much less, while leaving the resistance unaffected. Sufficient force parallel to the plug pins would extract the plug—it was meant to! But it should be remembered that the ladies, who use plugs a great deal, appreciate a plug which does not offer undue resistance to withdrawal. From these results I can only conclude that Mr. Cameron Brown has in his installation a very inferior version of the 13 A socket outlet (and I know from experience that all types are not equally good) or more probably that heavy impact on his protruding adaptors has led to socket damage. (It is significant that other letters also refer to dissatisfaction with adaptors.) It is also possible that loose terminal connections such as may occur occasionally in any type of socket outlet after much use could cause the radio interference described as well as heating of the terminal and socket assembly, so weakening the spring contact.

While in a short letter it is not possible to deal with the subject fully, my experience has been that the 13 A socket and plug, with its associated ring circuit, has proved an extremely satisfactory method of supplying domestic premises. As the 13 A socket outlet is usually complementary to a ring circuit, perhaps I should add a reminder to Mr. G. Millett (*Electrical Review*, 13th February) that the I.E.E. Regulations do not allow 15 A sockets to be supplied from such a circuit.

Ipswich. W. E. SAGE.

I WISH I had Mr. R. H. Robinson's confidence in the arrangement of these sockets, plugs, ring circuits and spurs. This type of installation is a delusion and a snare for the searcher for cheap and serviceable installations.

The use of scores of little fuses scattered *ad lib* around the houses may have its points. However, the user may run his 30 A circuits and sockets (for that is what they really are) at 50 A for 100 minutes if he wants to before the h.r.c. 30 A fuse will fail. You can also see plugs on 200 V systems carrying 2·25 kW fires and after a little time blisters appear on the cap.

I am sure, therefore, that the Institution of Electrical Engineers will require to revise their ideas when people really begin in earnest to use electricity for heating houses of 1,000 sq ft and the outdoor temperature is below freezing point.

Watford. MALCOLM V. FERRIER.

Car Electrical Systems

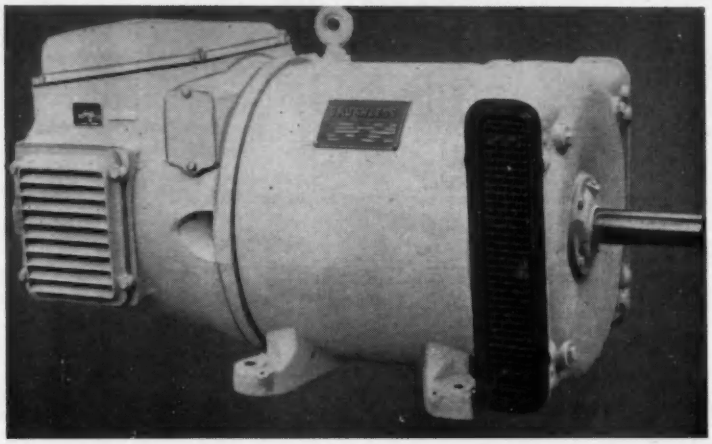
RECENT weather conditions have caused motorists a lot of trouble. For one thing, I think they have revealed that the electrical equipment is the weakest part of any vehicle. There is no doubt that the automobile manufacturers have still not produced a model which the owner can expect to use day in and day out in the snow, ice and fog which are to be expected every year in many parts of this country.

Why the electrical circuits are placed in their present vulnerable position so that any muck, slush or water is thrown on them, I cannot understand. I really think the *Electrical Review* ought to launch a prolonged attack on the motor manufacturers for being so stupid on their electrical side.

"STRANDED."

Brushless Alternators

REDUCED MAINTENANCE AND SIMPLE CONTROL SYSTEM



CONVENTIONAL excitation systems are used by the brushless alternators recently developed for aircraft use. An industrial version, just introduced, is no exception. These machines should not therefore be confused with self-regulating alternators. Self-regulating machines employ special windings in the exciters while other types, which should be designated " self-exciting " alternators, usually employ static excitation systems. The object of all these machines is to reduce maintenance of complicated parts so that the machine can be run by unskilled staff. Although the brushless alternator is not a direct descendant of the self-regulating and self-exciting machines, it is the next important step in development. Brushless machines are only now being manufactured as their development has had to await the production of reliable rectifiers capable of withstanding high centrifugal forces.

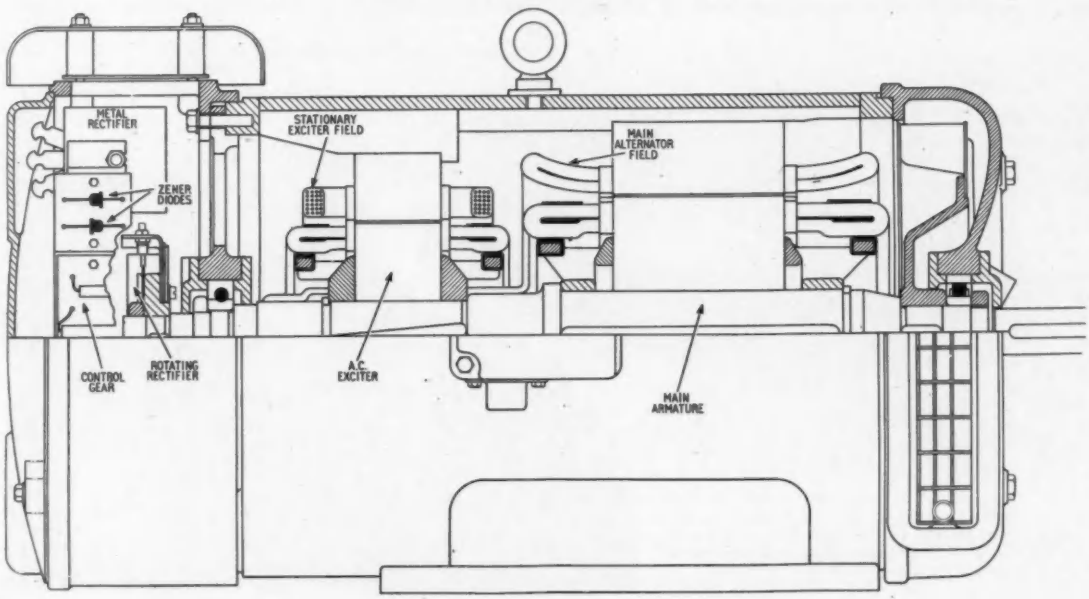
The brushless alternator recently introduced by the Macfarlane Engineering Co., Ltd., is of the revolving field, non-salient pole type of construction. The supply to the field is from an exciter which is in itself a small revolving armature machine. The three-phase output from the exciter is fed directly to rectifiers which rotate with the shaft and the output of the rectifier supplies the main alternator field (see Fig. 1). The exciter field is supplied by a transistor pre-amplifier.

The rotating rectifier consists of hermetically-sealed silicon diodes mounted on fins specially designed to facilitate cooling. The unit is mounted on the exciter shaft close to the incoming cooling air and is adequately rated for both voltage and current surges.

There are no brushes, no slip-rings and no commutators and the alternator mechanical design is based on the Macfarlane " L-range."

Control is obtained by matching a quality proportional to the alternator voltage against an artificial reference (Fig. 2). Any subsequent error is amplified, firstly by the transistor amplifier and secondly by the exciter. Voltage

Fig. 1.—Macfarlane brushless alternator



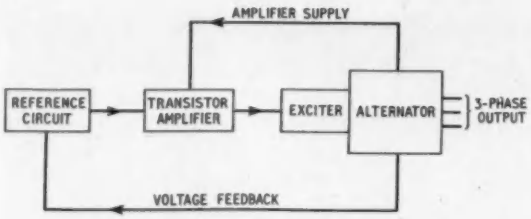


Fig. 2.—Schematic diagram of control circuit

feedback is obtained either from stator tappings or from the output terminals via a transformer. The resultant a.c. is rectified and the output is applied to a reference and comparison circuit. Zener diodes are used to provide the reference.

The transistor unit together with the potentiometer unit are mounted in the inlet air to the exciter. A hand-operated rheostat is provided to obtain any desired voltage within the range of the machine which will then regulate itself at that voltage within 1½ per cent standard. This regulator is the only external item of equipment on the alternator.

The machines are being manufactured in ratings from 10 to 150 kVA at 1,500 r.p.m. for voltage ranges from 190/205 V to 410/440 V at 50 or 60 c/s as standard. The machines have Class E insulation.

DIESEL-ELECTRIC LOCOMOTIVE FOR OVERSEAS

1,100 H.P. MIXED TRAFFIC UNIT

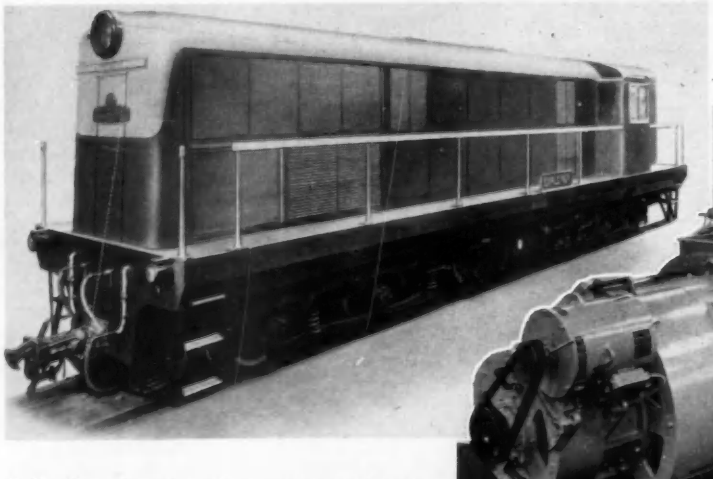
OPERATING conditions on overseas railways necessitate locomotives designed for use at high temperatures and occasionally high altitudes, hauling both freight and passenger trains. A prototype metre gauge mixed traffic diesel-electric locomotive, the "Explorer," capable of continuous operation at sea level in an ambient temperature of 120 deg F or at an altitude of 4,000ft in an ambient temperature of 85 deg F, was demonstrated last week at the Rugby works of the British Thomson-Houston Co., Ltd.

The locomotive, of the narrow hood type with a single cab, has removable doors and roof sections to provide access for inspection and maintenance. The underframe, manufactured by the Clayton Equipment Co., Ltd., is constructed from standard sections and plates, with draw-gear and brake couplers fitted to the underframe headstocks, and the superstructure is a steel framework clad with steel and light alloy sheeting. Each six-wheel bogie has two rubber cone pivots on which the body is carried, and Skefko roller bearing axle boxes are provided. The cab is equipped with two driving positions which can be arranged for left- or right-hand side driving, each having control levers for power and braking with instruments and alarms.

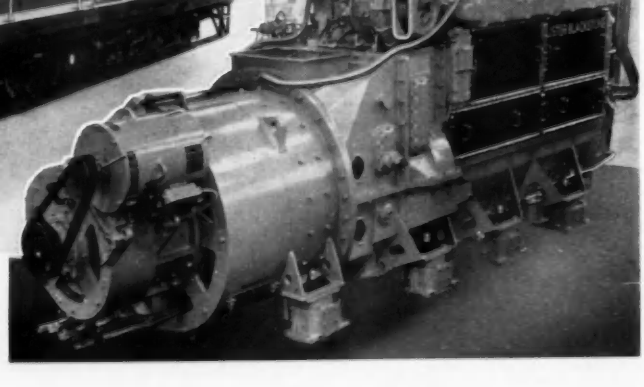
The diesel engine is a Lister Blackstone type ERS.12-T four stroke, exhaust turbo-charged 12-cylinder unit having a continuous rating of 1,100 b.h.p. at a crankshaft speed of 800 r.p.m. The two lines of six cylinders are axially parallel, and the two crankshafts drive the generator shaft through gearing, a generator speed of 1,320 r.p.m. corresponding to an engine speed of 800 r.p.m.

Flexible couplings and dampers are interposed between the engine and generator to smooth out torque variations transmitted from the engine crankshaft and to prevent reversal of gearwheel tooth loading, in addition to damping any torsional oscillations between the two banks of cylinders.

The main generator is a 10-pole machine continuously rated at 675 kW 515 V or 670 kW 290 V at 1,125 r.p.m.,



Left: The 1,100 h.p. "Explorer" locomotive



Right: The main and auxiliary generators and exciter are driven by a 12-cylinder Lister Blackstone diesel engine

and the auxiliary generator, on the same shaft as the traction generator, is an eight-pole, shunt-wound machine rated at 48 kW at 110 V d.c. The exciter, mounted on the auxiliary generator and belt driven from the traction generator shaft, is a four-pole machine with self and separate field windings and a differential winding carrying the main traction current. Each of the six axles is driven by a box framed type axle suspended traction motor driving through a single reduction gear with a 13:66 ratio. The traction motor cooling air is supplied through flexible ducts by two motor driven centrifugal blowers.

Cooling air for the engine water and oil radiators is drawn from the sides of the locomotive and expelled by two axial flow type fans directly driven by vertical motors. Two electrically driven exhausters are installed when vacuum braked trains are to be handled, each of 60 c.f.m. displacement at normal speed, doubled when required to release the brakes. A 48-cell Chloride lead-acid battery of 144 Ah capacity is provided for engine starting and auxiliary purposes. Headlamps, marker and number lights can be provided, with interior lights and sockets for hand lamps if required.

Engine starting is accomplished by using the main generator as a motor, taking its power from the batteries. "Forward" or "reverse" is selected and the power handle advanced. This causes the six traction motors to be connected in parallel to the main generator and provides weak field excitation to the generator. Further movement of this handle progressively increases excitation and increases the governed engine speed by pneumatic control. When the locomotive reaches a predetermined speed, dependent upon the throttle setting, the single traction motor field weakening step provided is automatically introduced. When running at full power, the generator excitation is automatically adjusted to maintain full load on the engine. In addition to the Westinghouse pneumatic braking system, a dynamic braking facility is provided, the generated power being dissipated in resistor banks, in the form of grids of high resistance steel strip. These are arranged for forced ventilation, the cooling air being supplied by axial flow fans driven by totally enclosed electric motors. The power and dynamic braking controllers each comprise a cam-operated multipoint switch mounted in a sheet-steel cabinet. The power controller has two handles: one controlling the generator field, traction motor contactors and the pneumatic engine speed control equipment, and a second, mechanically interlocked, which operates a reversing switch. The dynamic braking controller operates a rheostat regulating the exciter field. Electro-pneumatic contactors each having a continuous rating of 500 A are used as motor contactors and an electro-pneumatic reverser is employed to reverse the field connections of the series traction motors. Provision has been made for controlling up to three locomotives from one driving position.

The locomotive, which has a maximum service speed of 55 m.p.h. and a maximum tractive effort of 42,000 lb, will shortly be shipped to Africa, when extensive trials will be carried out on a branch line of the East African Railways and Harbour Board's system.

EUROPEAN REACTOR PROJECT AT WINFRITH HEATH

A TWELVE-NATION project for the development of British ideas for an advanced type of nuclear power station based on the high temperature gas cooled reactor has been approved by the steering committee of the European Nuclear Energy Agency. Approval by the councils of Euratom and the O.E.E.C. is expected to be a formality. The principal partners will be the United Kingdom and Euratom, with Austria, Denmark, Norway, Sweden and Switzerland.

The project, which will be carried out at the United Kingdom Atomic Energy's establishment at Winfrith Heath, is expected to cost some £13·6 million over a period of five years. Of this Britain and Euratom will each provide £4,340,000 and each of the other five countries £1,130,000. The balance of £3,600,000 will be met by Britain, which will retain the reactor and other equipment.

The experimental reactor will generate 10 MW of thermal heat and give an electrical output of 2 to 3 MW. It will be designed principally to test methods of harnessing nuclear power for electricity production and to experiment with materials capable of withstanding very high temperatures. A zero energy assembly which will enable reactor cores of different designs to be tested under high-temperature conditions and their nuclear properties studied will begin working at Winfrith Heath this summer. It is expected that a team from the participating countries will be assembled in the next two or three months and that a start will then be made on the design and construction of the larger power producing reactor.

Present information indicates that the reactor will use highly enriched ceramic fuel elements incorporating U235, thorium and graphite. Later U233 produced from the thorium might be introduced. Temperatures of up to 1,500 deg C are expected to be reached in the fuel elements and it is hoped to achieve gas outlet temperatures of 750 deg C. Helium is likely to be used to extract heat from the core.

Ultra-Sound Image Camera

THE ultra-sound image camera enables a visible image to be reproduced of the ultra-sound intensity distribution on the camera face. Coupled with acoustic lenses and immersed in a suitable medium the internal structure and substances or objects transparent to ultrasonic waves can be studied with the instrument. In its use it is complementary to X-rays and to ultrasonic pulse-echo inspection methods. It has applications to the non-destructive testing of materials and engineering components and also to medical diagnosis.

An ultra-sound camera tube and complete viewing equipment have been built by Messrs. C. M. Smyth and J. F. Sayers through the support of the R. W. Paul Instrument Fund Committee with the facilities of the Physics Department of the Northampton College of Advanced Technology, London. It is one of several possible types of ultra-sound camera and in a lecture which the authors delivered before the Electronics and Communications Section of the Institution of Electrical Engineers in London on 18th February, a description was given of the instrument and of its performance and typical applications.

Electrical Manufacturers and B

INFLUENCE OF TECHNICAL INFORMATION ON THE ARCHITECT'S SPECIFICATION

By R. BADEN HELLARD, Dip.Arch., A.R.I.B.A., F.I.Arb.

IN the development of technology the building industry has lagged behind other British industries by the very nature of its problem, and although the rate of increase in industrial productivity has been considerably greater in Britain than it was before the war, the effect on the building industry's productivity is generally lower. Since the capital investment in building is the largest in any single industry—it was £2,078 million in 1956—the productivity of the industry is of critical importance to the nation's economy. Architects and builders alike are now seeking new and better, or cheaper, ways of carrying out almost every operation, and for almost every piece of building structure and equipment.

The Architect's Task

Part of the electrical industry is very directly concerned with the building industry, but from the architect's point of view electrical installations and equipment present only one set of problems among the many others, which include structure, amenity, services, finishes, equipment, costs, æsthetics, and clients' individual preferences. His job is to allocate money, and consequent standards of quality and performance, between each of these factors, and the importance of each will vary according to the particular job. For many, the electrical equipment is a highly technical and often closed book, and it in no way follows that an electrical engineer will be available to advise him on each and every job. What he seeks, therefore, is the simple and brief, yet precise description of what any particular product is, where and how it can be used, and particularly what its effect will be upon other parts of the structure, for his design, as I have said, should properly co-ordinate all these aspects.

To secure the utmost efficiency and modernity the architect must constantly be looking for the latest and best way of doing something and he therefore is anxious to receive the latest information from manufacturers. This does not mean that he wants to be "sold" the product; if the information is properly presented, the product—if it is the right one—will sell itself to him. The architect will always be asking himself the broad question "Is there a better way of doing it?" Thus, when he looks at new products he will ask himself "Is this product as good as the one I am using, and is it cheaper?" or "Is this a better product than the one I am using and no more expensive?" If the answer in either case is clearly "Yes," then the product cannot be left out of his specification. In both these questions cost is the qualifying factor, and in the first instance it can only be the manufacturer who can supply the answer. Discussion around the properties and qualities of any new material or product will often be irrelevant if discussed in the absence of cost information.

Many manufacturers are reluctant to state precise costs in their trade literature addressed to architects. They say that, apart from the fact that the costs of their raw materials and labour fluctuate so much that the stated cost of a finished product may be out of date even before the literature is printed, there are also the complexities of delivery charges, quantities, and discount rates to different sections of the building industry. Of course much depends on the material or equipment in question. Whilst it is feasible to quote a price at works for a single item, say a standard immersion heater element, it will be much harder to quote for an under-floor heating system, or a busbar chamber, which will depend on individual requirements. Manufacturers often say that quoting a figure in their trade literature gives architects the idea that that figure will obtain in all cases, whereas it may well be lower for a large quantity near the works, or higher for a small quantity at a distance. Also they say some materials are handled by agents and there are the complexities of the discount rates. There is, of course, also a much greater reluctance to give this information where there is one price for the public and another for the trade.

These reasons are all valid, but are often used only as an excuse to invite further inquiries from architects so that representatives can call to discuss a contract and clinch the sale. The architect, recently the subject of much criticism for his inability to control the costs of a building, has not the time to pursue the cost of each and every item in the building by telephone calls or letter to the manufacturer, or by receiving his representative; he must have a guide figure available right at the commencement of his selection if he is not to develop his design with products which he discovers, too late, are beyond his client's permitted expenditure. In even the simplest building there are upwards of 10,000 decisions to make, most of which will have some effect upon the costs of the finished building. It is not surprising, therefore, if 10,000 times an unknown cost figure amounts to very much more in total tender for a building than the sum which has been allowed to him by the client for his design.

Effect on Overall Costs

The cost of an item of equipment can no longer be considered in a vacuum. The manufacturer is now coming to appreciate that his product will have an effect upon others with which it is used, or into which it is fitted. This effect on cost may be an immediate relationship through its dimensions, weight, capacity, output, etc., or it may be an indirect one on the capital cost of a project. For example, the incorporation of a heating system with an electrode boiler will save the construction cost of flue, boiler house, and maybe even access roads and excavation for access to the boiler house by delivery vehicles. Or again its effect may be through the balancing out of maintenance or running costs against a higher or lower installation cost, and since all these factors—particularly the last two—will change with almost every installation the task of giving costs will necessarily be beyond the manufacturer's capacity.

Is it therefore worth giving anything in technical literature, and if so what should it be? Generalisation on this subject must be dangerous for each specific product will present different problems, but the accom-

Building Costs

At the end of his article "An Architect's Approach to Floor Warming" in our 31st October issue, the author mentioned the need to thoroughly assess the cost of any new product or technique in its installed state in the building, and suggested that the manufacturer's presentation of his information should follow the recommendations regarding both size and content laid down in B.S. 1311 : 1958. The first point was taken up by a correspondent, and the ensuing correspondence has raised a number of questions and has led to this second article

panying tables summarise the questions asked in my office and in many others. The points put to representatives or by letter to manufacturers elucidate the general properties of the material or product, and similar questions about such matters as running costs, maintenance costs, life, etc., should produce at least a few short sentences on the nature and extent of a product's influence on other materials, and the general building project.

Five Stages

I have said that the architect's problem is one of obtaining information, but there is a further qualification of this requirement. He needs this information in stages as his design develops, and these stages may be summarised under five headings. The first is the client's requirements. This is when the architect attempts to discover the client's needs and the money he is prepared to spend, and relate the two. The second stage is that of the brief preparation, when the architect sets out the client's requirements in more detail and attempts to discover the consequences of a different building solution —for example, low or multi-storey building, steel frame or concrete structure, compact or dispersed plan, local or central heating, high capital and low maintenance cost, or vice versa, and this is when the broad information of the cost effect of new technological developments will be considered.

The third stage is his sketch design when he considers where various items of equipment should be sited, and so will need to know the approximate space to be allowed for these items. The fourth stage is the constructional design, when he develops the working drawing for the building, and will need to know in detail the dimensions, costs, size range, capacities, etc., so that he may include them in his specification and final drawings which become the contract documents. For the final stage he will need firm details of cost, delivery dates, etc., sufficient to make contractual definitions.

It is not desirable, therefore, that all the information on a product which he requires should be presented together, unless it is given in such a way as will allow him to quickly see the preliminary information at the stage he requires it, the more detailed points being referred to later on when the initial selection has already been made.

Much of what has been said above applies not only to cost information but also to the whole field of information about technical trade products. The rapid development of new techniques has led to a tremendous profusion of trade literature in order to put over to the building industry the information it needs. Some of this comes through advertisements in the technical Press, but other sources are, of course, the articles in those journals and postal advertising—direct mail. Sales and technical representatives employed by manufacturing firms also act as channels of communication for this information.

This profusion of methods has perhaps been partly responsible for the lack of clarity of purpose of some of this technical advertising and for the growth of the direct mail system. It also led to the production in 1946 of B.S. 1311 which was subsequently revised in 1955 and 1958. This Standard not only sets out size, but makes recommendations for content and format as well. The sizes recommended for the building industry were 11in by 8½in and 8½in by 5½in, and with the revision in 1958 the Continental "A" range of sizes, in practice 11¾in by 8¼in and 8¼in by 5¾in.

Types of Technical Literature

There would seem to be three functional groups of manufacturers' technical literature. The first is the "announcement" or "foot-in-the-door" type, which generally conveys the minimum of information about a new product, and merely attempts to catch the eye and inform the reader of the product's existence. This is, of course, a very necessary function of advertising literature, and is quite often very well done with comic strip, colour, or any of the normal advertising "gimmicks." The second group which must follow up this announcement gives the technical details of size, shape, cost, method of supply and so on, whilst the third group is "prestige" literature, which merely acts as a constant reminder that the manufacturer, or the product, exists.

The first and last of these three groups are at present quite adequately covered by the advertiser and his agent who understand these functions well. It is in the "information" group where the need would seem to be not fully understood, and certainly only infrequently executed with any success. This may be partly attributable to the lack of the right people to prepare the advertising, but is also due in part to the lack of understanding of how it is to be used. This confusion has led to the introduction of a few technical details into both of the other groups of advertising matter—generally to their detriment.

Let us now examine how the information is used, and see what are the difficulties that it presents to the user. There is no doubt that the first problem is the ability to suitably file away the information until it is required, and this brings with it the complementary problem of finding it again. Two fundamentals emerge from this realisation: first, size (adequately dealt with by the B.S.), for if all the information was produced to the same size the filing problem would be made easier; secondly, it is essential to have some readily usable classification, and this, once established, will imply that each information sheet

should be arranged to deal with one particular subject.

Research is at present going on at the Building Research Station, and by other bodies, on what classification system is the most suitable for building trade information, but already general agreement seems to have been reached that the system should be based on a functional "breakdown" of the products, so that the seeker knowing his problem (shall we say dealing with insulation) goes to a section headed "Thermal Insulation" and there finds all the materials which are suitable in one form or another, rather than being forced to look under a classification of material types to find his answer. By the latter method he might overlook or, indeed, have never heard of some material which could answer his problem of insulation. For example, it may not readily occur to the seeker that a material made of glass could be a good insulator, but if such a product was filed under the classification of "Insulation" it would not then be overlooked.

Importance of Up-to-date Records

To establish such a filing system in an individual office would be very expensive if it is to be sufficiently comprehensive and kept up to date. All jobs bring to architect and builder the opportunity or necessity of using a range of materials new to them, and the opportunity may not recur for another two or three years. At this time, assuming the information has been properly filed and is readily found, there will come the question "Is the information up to date?" This could be verified by a telephone call or letter to the manufacturer, when quite often it is found that his telephone number or address has changed in the meantime, and this results in further time-consuming delay which can be ill-afforded and could be avoided if the information was kept up to date with the minimum of effort, for obviously the larger and more comprehensive the service is the more time will be spent on its maintenance.

The larger manufacturers have representatives, and one of their tasks could be to keep the architects' filing systems in respect of their own product up to date in all the offices in the area in which they call. This would still leave the main bulk of suppliers and the building industry uncatered for, since only the largest suppliers maintain a nationwide sales service that could do this.

The smaller manufacturer could not do it, nor would it be sensible for him to spend a lot of time covering offices where his products can only occasionally be used. This has no doubt led to the increasing use made of the direct mail system of advertising, and this successfully solves the problem of dissemination of the information, and, if it is of the correct size, presents it in an easily filed form. If it is also properly classified and each individual leaflet deals only with a particular subject the architect's filing problem is further eased.

But it should be remembered that the bulk of architectural practice and a very large amount of building is carried out by small offices, and any administrative work presents an "overhead" load which they can ill afford. It is not surprising therefore that as the problem has grown and in the past few years become acute, two organisations have come into being to take the solution of this problem a stage further by providing the architect with a filing service which gives manufacturers' information properly classified. One concern maintains a standard filing cabinet in an architect's office where information is filed under a manufacturer's name which is referenced by an index to a type of material, and is kept up to date by regular visits from the company's staff, thus saving all maintenance costs in the architect's office for a small annual subscription.

The other organisation classifies the information direct under the functional "breakdown," and sends it regularly for inclusion in leather-bound loose-leaf binders with visible index tabs to 56 main sections, each with ten subsections. This service distributes only matter which is to British Standard size and contains adequate factual information, and this is ensured by a "vetting" committee, consisting of some of the most eminent architects,

INFORMATION REQUIRED ON A PRODUCT

IDENTITY (briefly)	Trade Name	
	Composition/Purpose	What is it? What does it do? What is it made of?
	Manufacturer	Name Head office address Telephone number
PROPERTIES (detailed)	Type/Purpose	
	Composition	
	Colour/Texture	
	Size	height length width thickness tolerances
	Weight/Density	
	Strength	tensile compression/crushing shear impact adhesion abrasion
	Resistance	low temperature high temperature flame fire staining water vapour electrical
	Moisture movement	
	Heat	expansion resistivity conductivity
	Sound	absorption reflectivity
	Light	diffusion absorption reflectivity
	Performance	span/loading capacity output limitations
SUPPLY	Packing/Container	
	Locality	area offices works/depots agents/licensees
	Method	postal delivery public road rail
	Guide cost	supply only labour only erected or fixed
	Discount	quantity trade monthly cash
	Guarantees	
	Supporting Services	design/layout erection/fixing maintenance
APPLICATION	Fixing	normal uses other uses
	Protection/Storage	on site fixed
	Draft Specification	
	B.Q.'s Information	
	Miscellaneous Recommendations	

INFORMATION REQUIRED ON A SERVICE

IDENTITY (briefly)	Firm's Name	
	Nature of Service	
	Address and Telephone No.	
SCOPE (detailed)	Nature of Service	What is undertaken What is not undertaken Are there limitations? Is it impartial?
	Operation	How is it invoked? Information required How is it paid for? Cost guide
	Locality	Area of operation Area offices Works/depots Agents/licensees
EXAMPLES (optional)	Work Completed	Identity of building Persons responsible What was done
	Recommendations	

NOTE: This list is neither complete nor always applicable.

which meets monthly. Since the distribution is by post, the circulation can be much larger, and in fact includes an overseas service as well. This service is available to architects for a nominal subscription only, and since greater attention is given by the organisation to the quality of the information it distributes, these volumes—constantly up to date—can have a very marked influence on the architect's specification.

I think I have shown that the architect has, above all, only limited time in which to seek the answers to his technical problems in developing a building and specifying the products to be used. He will therefore look kindly, indeed he may only have time to look at all, towards the manufacturer who gives him succinct information on his products in a standard format and on loose-leaf British Standard size leaflets, setting out the advantages and more particularly the disadvantages of the product including always a valid cost guide.

The manufacturer with a good product who presents his information about it in this manner will reap his reward in the architect's specification. He will not then need a sales force but should find greater demand for the final information required by the architect for stages 4 and 5 of his work, knowing that by this stage the actual selection of his product, or of one or two alternatives, has already been made. He can then pursue the inquiry with the knowledge that a definite sale will more often than not be made.

ST. CLEMENT DANES' BELLS

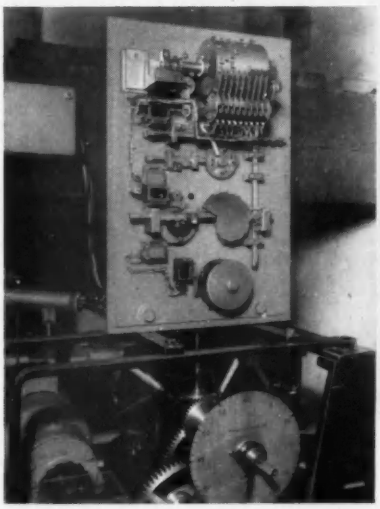
DAMAGED by bombing during the war, the church of St. Clement Danes in the Strand, London, was rebuilt last year and re-dedicated as the official church of the Royal Air Force. Although a traditional design has been employed for the church fabric and fittings, electrical equipment has been installed for striking and chiming the bells, including the playing of three tunes—"Oranges and Lemons," the Royal Air Force March and the "Old Hundredth."

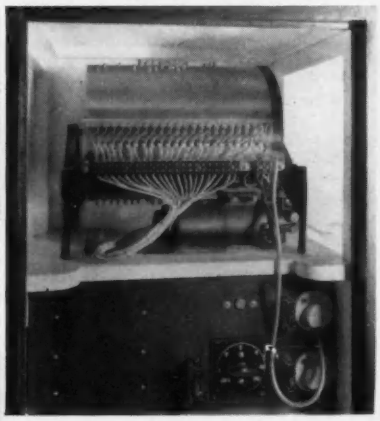
The bells, which were recast by the Whitechapel Bell Foundry using metal obtained from the damaged bells salvaged from the old church, were hung at a lower level in the tower than the original bells to minimise the effect of the horizontal forces produced when the bells are swung during manual ringing. An additional bell was added to the original ten, enabling "Oranges and Lemons" to be played in the correct key.

The clock, manufactured by Thwaites & Reed, Ltd., of Clerkenwell, has a gravity escapement and one-second pendulum, and automatic rewinding is carried out at 20-minute intervals by a ¼ h.p. Crewe Allen geared motor. The same company manufactured the Westminster quarter chimes and hour strike movement. A wheel driven at one revolution per hour by the clock mechanism has four release pins which control the starting of the quarter chime barrel mounted at the top of the panel. Projections on this barrel actuate Bulgin micro-switches, causing the bell hammer solenoids to be energised in chime sequence. A horizontal rack, regulating the number of hour blows struck, is released at the completion of the fourth quarter chime and arrested by a stepped snail wheel rotating once every twelve hours. A drum at the bottom of the panel, rotating once every 24 hours, starts the carillon machines at pre-set times and prevents striking and chiming during the night.

Three carillon machines developed and manufactured by the Whitechapel Bell Foundry are at present installed, one for each tune. Each consists of a 10in diameter barrel driven by a variable speed Citenco geared motor through worm and wheel reduction gears, pegs on the drum operating Honeywell-Brown micro-switches. A drum revolution time varying from 1½ to 2 minutes is allowed for each tune and in this time up to 168 bell strokes are made. A rotary switch is fitted for tune selection and a manual starting button is incorporated, enabling tunes to be played at any desired time.

Each of the eleven bells is fitted with two hammers operated by solenoids with Westool coils, enabling blows to be struck in quick succession. Resilient joints in the mechanical linking cause the hammer to throw-down on to the bell after completion of the solenoid stroke. The micro-switches in the clock and carillon machines operate Londex mercury relays which control the 230 V d.c. solenoid supply. This is obtained from the 230 V single-phase a.c. mains through Westinghouse rectifiers. The major part of the installation was carried out by the Whitechapel Bell Foundry with the exception of the belfry wiring which was installed by Maintenance Contracts, Ltd. The consulting engineer for certain aspects of the electrical installation was Mr. Forbes Jackson.





Left: Chime and strike movement above the clock mechanism. Centre: Carillon machine showing the tune selector switch. Right: Solenoids and the hammer mechanism

INDUSTRIAL NEWS

Volume of Exports and Imports

The volume index for British exports of electrical machinery, apparatus and appliances in 1958 was 123 (1954=100), or 3·2 per cent lower than in 1957. In the final quarter of the year, however, the volume of exports was 3·2 per cent higher than in the corresponding period of 1957. At 1954 prices the value of exports in 1958 is estimated at £209 million compared with the declared value of £224 million.

The volume index for electrical imports in 1958 was 162 compared with 140 in 1957, and the value at 1954 prices was £113 million against an actual value of £137 million.

Recent B.T.H. Orders

The accompanying picture shows one of eight 40,000 kVA 3-phase 60 c/s 115/34·5 kV transformers supplied by the British Thomson-Houston Co., Ltd., for the Bolivar Coast oilfield substations of Compania Shell de Venezuela being unloaded at Lake Maracaibo in Western Venezuela. The transformers, which were made at the B.T.H. Rugby Works and are fitted with on-load tap changing equipment, are the main step-up and step-down units for the transference of power in bulk throughout the oilfield.

The B.T.H. Co. also recently shipped the first of twenty-five 330 kV oil circuit-breakers for the Kariba hydro-electric scheme, Rhodesia, from its Willesden factory. These circuit-breakers, which have a breaking capacity rating of 7,500 MVA, are of the bulk-oil lenticular-tank type. In addition to the standard short-circuit tests, the programme of proving tests for the design included low inductive and capacity-current switching, and the contract further specifies that certain of the breakers must be suitable for three-phase auto-reclosing; also that five units must be suitable for single-phase auto-reclosing duty—a feature required in the initial development stage when single long 330 kV transmission lines will be employed. The circuit-breaker's performance has been proved to be well within the guaranteed figures.

B.T.H. 40,000 kVA transformer being unloaded at Lake Maracaibo, Venezuela

U.S. Objections to British Order

The protests in this country at the rejection by the United States authorities of the English Electric's tender for two water turbines for the Greer's Ferry station were last week matched by no less vigorous objections from United States Congressmen at the award of the £4·3 million contract to C. A. Parsons for a 500 MW turbo-generator for a steam station of the Tennessee Valley Authority.

The lowest American tender of about £6 million was submitted by the General Electric Co. of Schenectady and the local Congressman, Mr. Samuel Stratton, whose request to the T.V.A. to reconsider their award was turned down, asked President Eisenhower to intervene and obtain the order for the General Electric because Schenectady was "suffering from a worsening economic situation." The President was also asked why a British tender had been accepted when previously "in the same situation" a British bid had been passed over.

New York's two Senators asked the Government's Office of Civil Defense Mobilisation to have the award of the T.V.A. contract withheld pending a ruling on imports of heavy electrical equipment. The Office is already considering a petition from American electrical manufacturers for a ban on such imports in the interests of national security.

In a message from Pittsburgh, Pennsylvania, *Reuter* says that the Westinghouse Electric Corporation, which submitted one of the tenders which was passed over, has also joined in protests against the award of this contract.

Mr. A. C. Monteith, vice-president of the Corporation, said in a Press statement that if the contract had been awarded to Westinghouse it would have kept its workers busy for two years at plants in East Pittsburgh and Lester, Pennsylvania. The decision to let the contract to a foreign manufacturer was "a precedent-setting decision that I strongly believe is short-sighted from the standpoint of the employment of American workmen, and downright dangerous from the standpoint of our national security."

Officials of the International Union of Electrical Workers and also the Association of Westinghouse Salaried Employees have urged their members to send protest messages to their Congressmen. Four Congressmen—two Senators and two members of the House of Representatives—have lodged official protests.

New B.I.C.C. Film

Last week we attended the first showing of a new film sponsored by British Insulated Callender's Construction Co., Ltd. Entitled "On the Track of Efficiency," it shows the planning, design and installation of overhead equipment for the 25 kV 50 c/s system adopted for many railway lines in Britain. The first contracts for this work were awarded to the B.I.C.C. Group by the British Transport Commission, who gave permission for parts of this film to be made on their tracks. After scenes showing basic design of the equipment, survey of the tracks and testing of fittings, the erection of the equipment is shown. Newly developed mechanical plant is seen in use as each phase of the work is shown from the setting up of the stores depot to the final checking of the completed equipment.

The film, which runs for 19½ minutes, is available in 35 mm and 16 mm and is in colour with a spoken commentary. Copies of this film are available on loan, free of charge, to institutions and societies on application to the Librarian, B.I.C.C. Group Film Library, 21, Bloomsbury Street, London, W.C.1, or to any of the company's branches or district offices.

TV Tube Repairs

Siemens Edison Swan, Ltd., is now able to accept television tubes for repair. This new trade service covers all types and sizes of Ediswan Mazda television tubes and includes any type of repair which can be carried out within the Customs and Excise requirements relating to "identifiable" tubes. All tubes will be re-screened. Therefore such tubes repaired by Siemens Ediswan will not be liable to purchase tax. All tubes repaired under this scheme will be known as "Extra-Life" and will carry a six months' guarantee with an additional allowance of one month for possible transit and handling delays. Details are available from Siemens Edison Swan, Ltd., Extralife Department, 155, Charing Cross Road, London, W.C.2. It will not operate in Eire or the Channel Islands.

Electrolux Showroom

The showroom of Electrolux, Ltd., at 153-155, Regent Street, London, W.1, has been redesigned and modernised and includes sections displaying refrigerators, laundry equipment, cleaners

A section of the redesigned showroom of Electrolux, Ltd., in Regent Street, London

and floor polishers. The refrigerator section is shown in the accompanying picture.

Equipment for Central London Line

London Transport has placed orders valued at approximately £3,500,000 for the traction motors and other mechanical and electrical equipment needed for the Central Line train renewal programme announced last year. These orders are being placed in advance of the main order for the cars themselves and were provided for as "options" when contracts were made with certain companies for equipment for new rolling stock for the Piccadilly and Metropolitan Lines in August last year.

At a later stage, after trials of the twelve prototype motor cars ordered recently from Cravens, Ltd., Sheffield, it is intended to order approximately 330 new cars for the Central Line. These cars will be fitted with the equipment which has just been ordered.

The principal contractors for equipment for the Central Line trains are as follows:—Traction control equipment and auxiliary equipment, British Thomson-Houston Co., Ltd.; traction motors, General Electric Co., Ltd.; brake equipment and compressors, Westinghouse Brake & Signal Co., Ltd.; door equipment, G. D. Peters & Co., Ltd.; automatic couplers and disconnecting units, A.E.C., Ltd.; auxiliary electrical equipment, Patent Lighting Co., Ltd.; lighting and auxiliary equipment, Benjamin Electric, Ltd.

G.E.C. Traction Motor Order

The General Electric Co., Ltd., has received a further order from the London Transport Executive for traction motors valued at over £1·25 million. This is additional to the order worth £1·25 million for traction motors placed with G.E.C. shortly after the Executive's plan was announced. The combined value constitutes the largest order for traction motors ever placed by any railway in this country. It covers a total of 2,656 motors. Of these, 760 for the Piccadilly Line and 496 for the Metropolitan Line were included in the original order. An option was also placed at that time for 1,400 motors for Central Line stock, and it is this option that has now been taken up. The motors will be built at the G.E.C.'s new traction motor works at Dudley Port, Staffs. Deliveries will begin in September next. The Piccadilly Line motors will have a continuous rating of 80 h.p. at 66 per cent field. Those for the Metropolitan Line will be 70 h.p. at full field, and those for the Central Line 60 h.p. at 66 per cent field.

College of Agricultural Engineering

A new National College of Agricultural Engineering is shortly to be established by the Ministry of Education, in co-operation with the agricultural industry. It will cost about £250,000 and provide, initially, accommodation for between 60 and 100 students. Its purpose is to provide advanced courses (including sandwich courses) leading to a diploma and is designed to meet the growing need for qualified agricultural engineers. Sir Eric Ashby, D.Sc., Sc.D., LL.D., will be the chairman of the governing board.

E.T.U. Conference

The annual delegate conference of the Electrical Trades Union will be held at the Spa Royal Hall, Bridlington, Yorkshire, from 8th to 12th June. It is expected that about 370 delegates will be in attendance.

Illuminated Sign Design Competition

Entries for the illuminated sign design competition organised by the Electrical Sign Manufacturers' Association, which closed on 31st January, totalled 138. This is almost double the entries received for the last competition in 1957. Several entries were received from abroad. The entries will be judged on 25th February by Sir William Holford, F.R.I.B.A., Sir Herbert Manzoni, C.B.E., Sir Miles Thomas and Mr. U. Aylmer Coates, together with Mr. K. J. Oldham and Mr. G. S. Campbell, the chairman and vice-chairman, respectively, of the Association.

Following the judging the entries will be on view to the public without charge at the Assembly Hall of the Royal Commonwealth Society (Craven Street entrance), from 1.30 to 7 p.m. The main prizes will be presented by the Minister of Housing and Local Government, Mr. Henry Brooke, P.C., M.P., at a luncheon at the Savoy Hotel on 9th March.

Anglo-German Co-operation in Sudan

Reuter reports from Khartoum that the English Electric Co. and the West German Siemens Company on 14th February signed an agreement with the Sudanese Government for the construction of the £4,500,000 Sennar dam and hydro-electric project on the Blue Nile. The project will be carried out in two stages: the first will be started immediately and finished in January, 1961, and the second will be completed by April, 1962. The scheme provides for two power stations, one at the dam and one in Khartoum.

Washing Machine Survey

In our issue of 6th February (pp. 276-277) particulars were given of the "Parnall" range of washing machines

"Parnall" model EW.51 washing machine (Electrical Division of Radiation, Ltd.)

manufactured by the Electrical Division of Radiation, Ltd. The model EW.50 washing machine illustrated has now been superseded by model EW.51, a photograph of which we reproduce.

Safety in the Home

Commonsense advice for members and staff of housing committees (as well as for householders) is contained in an illustrated booklet prepared for the Department of Health for Scotland by the Central Office of Information ("Design for Safety in the Home," H.M. Stationery Office, price 1s 3d). Safeguards against all types of domestic accidents are suggested and those relating to the electrical equipment are sound. For instance, the danger of facilitating the use of portable electrical equipment near the

Photograph taken at the sales conference of the Simplex Electric Co., Ltd., held at the Grand Hotel, Folkestone, from 3rd to 7th February

kitchen sink is stressed. An adequate number of outlets is recommended to avoid the use of too many appliances by means of adaptors; a scale of points is suggested, but the numbers specified for each room should be regarded as minima.

Naturally the need for great care in the design of bathroom installations is emphasised and the prevention of staircase accidents by providing adequate lighting with two-way switching is also mentioned. Embedded-cable heating for exposed stairways to prevent freezing is said to be "not unduly costly to install and operate."

It is to be hoped that all those responsible for housing, whether in Scotland or elsewhere, will take note of the paragraph which says:—

"Provided that the wiring is properly carried out in accordance with the current regulations, there should be little risk of accident. Electrical accidents are almost always due either to defective portable appliances or their flexible leads or to temporary wiring put in by the tenants. Insufficient or badly placed points may lead to a need for such temporary work or to the use of adaptors with a multiplicity of leads."

E.A.W. Examinations

At the certificate examination for demonstrators held by the Electrical Association for Women in December last, there were 82 successful candidates, four gaining distinction. The total number of holders of this certificate is now 3,036. At the certificate examination for teachers held in December there were 35 successful candidates, one with distinction. The certificate is held by 2,299 teachers.

This year's winner of the Elizabeth Sloan Chesser Cup is Miss J. W. Dunlop (East Midlands Electricity Board, Coventry). The Cheltenham silver jubilee awards have been won by Mrs. Ida Barnes (E.A.W. Nottingham Branch), with Mrs. Helen Kingston (Blackburn Branch) and Mrs. Bertha Paul (Galashiels Branch) as the joint second prize winners. The Councillor Miss Walter Rosebowl, awarded annually to the school gaining the highest average marks in the home workers' examination for schools, was won by the Central Newcastle High School, Newcastle-on-Tyne. The runner-up was the Worthing County Secondary School for Girls.

Works Visit

A number of showroom supervisors and head and area office executives of the London Electricity Board recently visited the works of Morphy-Richards, Ltd., at St. Mary Cray, Kent. The visitors, who were entertained to lunch and tea, made a tour of the plant under the guidance of members of the staff, after which there was a "questions and answers" session. Similar visits are being made by two further L.E.B. parties.

Norway to Join Eurovision

Marconi's Wireless Telegraph Co., Ltd., has been awarded contracts from the Norwegian P.T.T. Administration and the Royal Board of Swedish Communications for a combined multi-channel radio-telephone and television link between the Norwegian capital, Oslo, and Karlstad (Sweden). A further section, carrying multi-channel radio-telephony only, is to be installed in Sweden between Karlstad and Arvika. The system is expected to be in operation by May, 1960.

The value of the order, which was obtained through Norsk Marconi-kompani and Svenska Radioaktie-bolaget, the respective Marconi agents in Norway and Sweden, is in the region of £100,000.

Annealing Plant for Foundry

A contract to the value of about £120,000 has been awarded to Birlec, Ltd., by Ley's Malleable Castings Co., Ltd., for additional electric furnace equipment for the annealing of pearlitic malleable iron castings from its new mechanised foundry at Derby. With an average output of 1 ton/hr the plant will comprise three main parts—a high temperature furnace, a fast cooling conveyor, and a low temperature furnace. Both furnaces will be of the type employing pusher mechanisms to progress trays of castings from end to end. Fully automatic means will be employed for transferring castings from the high temperature trays to the cooling conveyor and thence to the low temperature trays.

English Electric Indian Factory

The Indian Minister for Commerce and Industry, Mr. Lal Bahadur Shastri, opened a £300,000 English Electric Co. equipment factory at Pallavaram, near Madras, on 14th February.—*Reuter.*

N.I.C. at Southampton

A successful meeting was organised at Southampton on 11th February by the National Inspection Council for Electrical Installation Contracting. Apart from electrical contractors, many other interests were represented, including architects, builders, local authorities and women's organisations. The Mayor of Southampton presided and addresses were given by Brig. W. G. S. Thompson, O.B.E., chief executive officer of the N.I.C., and Mr. E. J. Sutton, M.I.E.E., chief technical officer.

Argentine Contract for Italy

A consortium of Italian and Argentine manufacturers has obtained a contract to supply 280 diesel-electric locomotives to the Argentina railway. According to the *Financial Times* the contract is worth around $60 million, of which $28 million will be spent in Italy and $32 million in Argentina.

The consortium—Gruppa Aziende Italo-Argentina—is already engaged on a $21 million contract for 56 electric locomotives and 18 substations for the Santiago-Chillan line in Chile.

All the motors for the 280 diesel-electric locomotives will be made in the Fiat plant at Cordoba, Argentina.

Italian companies will build 80 complete locomotives, apart from the motors, and of the remainder some parts will be produced in Italy and some in Argentina. Some of the work will be done by Siam di Tella, the Argentinian licensee of American Westinghouse, which is not a member of the consortium. The locomotives will be of two types, 1,050 h.p. and 1,350 h.p.

Disposal of London's Trolley-buses

A contract has been signed between the George Cohen 600 Group, Ltd., and the London Transport Executive for the disposal of practically the whole of the Executive's fleet of trolley-buses. Some 1,400 are involved. The conversion is due to take about three years and stage 1 will take effect from 4th March, when trolley-buses on three South London routes will be withdrawn and replaced by diesel buses. Many of the trolley-buses are in excellent order and may go into service elsewhere, either in this country or abroad.

Winfrith Heath

Reports in the Press that the Atomic Energy Authority was reconsidering its decision (announced last September) to move the controlled thermonuclear reaction project to Winfrith Heath have given rise to questions concerning the future of the Winfrith Heath establishment.

The Authority confirms that it is its intention to proceed with the build-up of this site. According to current plans, the programme of fission reactor development alone will result in an establishment of between 2,000 and 3,000 people by 1962. At the public inquiry into the Winfrith project in January, 1957, it was estimated that the establishment would have a staff of 1,200 by 1962.

Price Reductions

Midland Silicones, Ltd., has announced a further reduction of almost 20 per cent in the price of "Silastic LS-53," a fluorinated silicone rubber able to resist temperatures from −60 deg C to over +200 deg C. This is in addition to the 10 per cent reduction in the price of this rubber which the company announced in October of last year.

Mullard, Ltd., announces that it has reduced the prices of a number of Mullard radiant screen TV tubes.

Change of Address

The Electrical Contractors' Association of Scotland has moved to 23, Heriot Row, Edinburgh, 3. The telephone number (Caledonian 7221/2) is unchanged.

Trade Announcements

A free technical service has been instituted by the **Ultrasonoscope Co. (London), Ltd.,** to advise on all aspects of ultrasonic flaw detection and inspection. Companies having inquiries and problems relating to the inspection of billets, forgings, welds, plates, extrusions and certain castings (such as rolls) are invited to write to the company at Sudbourne Road, London, S.W.2.

Recent increases in the demand for the sintered metal products of the **Morgan Crucible Co., Ltd.,** have led to a move to larger premises. The sales office has been moved to Wandsworth Works, Point Pleasant, Wandsworth, London, S.W.18, and a new factory and laboratory established there for the production and development of "Sinterlink." This combines plant and facilities previously situated at Battersea, and Norton, Worcester. The final stage of the move will be completed by the middle of the year.

Servomex Controls, Ltd., has concluded an agreement with **Feedback, Ltd.,** whereby Servomex will manufacture and market Feedback designs. The range of equipment includes servomechanism components and assemblies as well as apparatus for servo-system analysis and demonstration. Mr. R. C. Steel, chairman and managing director of Servomex Controls, has been elected to the board of Feedback, Ltd.

In connection with the recent launching of its 12-hour time switch, **Hurseal, Ltd.,** 229, Regent Street, London, W.1, has produced a display pack for stockists. When open, the pack stands 10½in high with the trade mark, a 3½in red disc, at the crown. The pastel grey time switch is clearly seen against a background of red and black.

Printed Circuits, Ltd., Boreham Wood, Herts., announces that the installation of the "Multinex" automatic electronically controlled camera now enables it to offer design engineers a 48-hour service for the production of prototype printed circuits of any size and complexity.

The London showroom and office at 50-52, Great Peter Street, S.W.1 (telephone: Abbey 5908/9), of **A. A. Jones & Shipman, Ltd.,** Leicester, was opened on 28th January.

The applications laboratory of **Semiconductors, Ltd.,** is now installed in its new building adjacent to the company's Swindon factory.

Marconi Instruments, Ltd., is showing its telecommunication measuring equipment at the Leipzig Spring Fair (1st to 10th March), at the Institute of Radio Engineers' Convention, New York (23rd to 26th March), and at a private demonstration in Budapest in the latter half of March.

The Instrument Division announced by **Racal Engineering, Ltd.,** has been formed into a new company with the title of Racal Instruments, Ltd. Mr. J. H. Head has joined the new company as director and general manager.

New G.E.C. Cooker

A new electric cooker, the "Superb," claimed to be the only model with a full view drop down glass door, has just been introduced by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. Its general appearance is such that, with the company's "Fabulous Four" refrigerator, it forms a composite matching unit. Both the outer door and the heat resisting glass inner door are separately counter-balanced. By depressing the red button on the oven door the glass door is left closed.

G.E.C. "Superb" electric cooker

The "Superb" has an extra large thermostatically controlled oven (3,400 cu in) heated by six sheathed wire elements (485 W each) situated on the sides and bottom. The cooker controls include an oven thermostat, light and auto-timer (12 hour operating period), simmer controls for the two 8in "Superspeed" boiling plates (2,350 W each) and a three-heat switch for the grill boiler (2,500 W). The splashback also houses the switch and pilot light for a separately heated drawer at the base of the cooker (485 W).

The larger than usual grill boiler measures 8in by 13½in and the full-width grill chamber has an accident-proof gliding holder for the grill pan, which prevents the pan being tilted or pulled right out. The cooker is easy to clean, the hob being detachable, and the boiling plates and cross bar are removable. The oven interior can be withdrawn in three parts. The cooker measures 53in high (36in to top of hob) by 21in wide by 24½in deep, and is finished in white or honeysuckle porcelain enamel with cloud grey panels. The price is £65.

British Transistor Applications

Their Growing Use in Industrial Processes and Equipment

By T. D. TOWERS, M.B.E., M.A., Graduate Brit.I.R.E.*

So far most of the applications of transistors in this country have been in connection with radio equipment, computers, hearing aids and guided missiles. There have, however, been a number of developments in the industrial field, some of which the author describes in this article. In conclusion he expresses the view that the wider use of transistors in industry awaits the production of more of them of higher ratings

TEN years ago the Bell Telephone Company announced the invention of the transistor, a solid-state semiconductor current amplifier, destined to compete with the conventional thermionic valve in many applications. Large-scale production of transistors did not begin until five years later, but the last two years have seen a phenomenal increase in their use. Current estimates of transistor production in the United States place it at about three millions a month. Some 70 per cent are used in entertainment equipment (portable radio sets, gramophones, hearing aids, etc.), 20 per cent in industrial commercial equipment, and the remaining 10 per cent in military applications.

In the United Kingdom, the pattern of the use of transistors is probably somewhat different for various reasons, but the bulk of transistors used here are almost certainly in the entertainment field, while the spread of the transistor in the industrial field has been relatively slow.

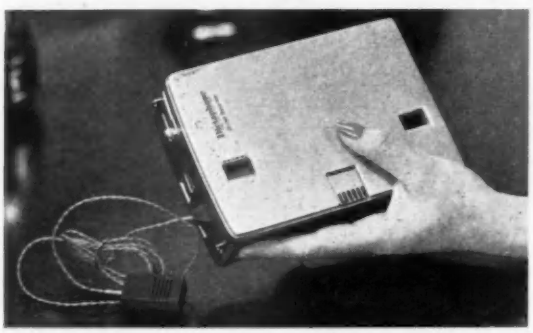
There are a number of possible explanations for the relatively slow adoption of transistors in industry here. The maximum power output of available types was initially limited; availability of some types has been restricted; selling prices have tended to be higher than for equivalent thermionic valves; transistor utilisation techniques initially presented difficulties to production engineers working with them for the first time; and finally, the familiar valve was securely established in non-expendable equipment and the use of transistors would normally be considered only at the end of the economic life of the valve-operated equipment.

Over the last year or so these obstacles to the industrial spread of transistor-operated equipment have been disappearing. Maximum power ratings have been going up as transistor fabrication improves. All types have become more easily available as more firms have moved into transistor production. Selling prices have been drastically cut in recent months, and the discrepancy between valve and transistor prices much reduced.

Transistor circuitry knowledge is being steadily spread by a stream of books and articles. The advance of automation frequently hastens the obsolescence of existing valve-operated equipment and presents opportunities for replacement by equipment incorporating transistors. Finally, the well-known fundamental virtues of the transistor—its high electrical efficiency, its reliability, its low heat dissipation level, its small size, its ruggedness, its freedom from microphonics and its long life, all offset the remaining power and frequency limitations and lead to our seeing the steady infiltration of the transistor into the industrial field.

The rest of this article is devoted to specific instances of the use of transistors in United Kingdom industry. For convenience, separate sections are devoted to process control equipment; material treatment equipment; indicating and recording apparatus; power supplies; and communication and sound reinforcement equipment.

* Newmarket Transistor Co., Ltd.



"Dictet" recorder by Dictaphone, Ltd.

Process Control Equipment

In process control, transistors have entered quite firmly into the industrial field. At the basic unitary level, for example, we find the ultra-sensitive transistorised relay produced by Magnetic Devices, Ltd. Relays form a fundamental component of many of the varied types of electronic control in use in industry, and the transistor-supplemented relay vastly increases the sensitivity of such devices. At the complex system level, on the other hand, we find transistorised devices for sequence control of machinery performing a number of related operations. Such a complex system was demonstrated by Mullard, Ltd., at the last Instruments, Electronics and Automation Exhibition.

Process control equipment transistor applications have

Pye 10 W transistor amplifier

advanced more rapidly in the United States than in this country because of the earlier availability of suitable transistors, and we do not find here yet many such complex examples of transistorised process control as the Bendix Aviation Corporation's tape control system for machine tools and Texaco's transistorised digital computer for fully automatic control of certain petroleum refining processes. The application of transistors in British process control equipment appears to have been carried out so far at a more modest level, and the accent has tended to be on individual packaged units rather than on large systems. It looks as though transistor equipment firms have been concentrating initially on general purpose units for system engineers to work with rather than on larger complex systems.

Batch counting equipment lends itself to transistor operation and there are several such counters on the market. A representative example is the Venner TBC counter containing four decades, each of which is controlled by a ten-position switch calibrated from 0 to 9. A number is set up on the counter and input pulse rates varying from one to 10,000 per second are injected. The counter stops after the required batch has been reached. In the same category there are Gate Electronics' transistor controllers having many applications in packaging, printing, plastics, paper, chemical and other plants. The controllers in this series are of modular construction, each functional unit being separate. A typical unit is the T.C.B. 100 which can count batches of up to 100 units, each at counting rates of 1,000 per second and batching rates of 300 per minute.

Another application of transistors in the field of process control equipment is to the photo-electronic counter relay. Photoelectronics (M.O.M.), Ltd., for example, produce a transistor-operated light-actuated switch in this category. This general purpose unit has a relay actuated by a photo-transistor and is intended for such operations as the counting of articles as they break a light beam, automatic paint spraying, paper breakage alarm, automatic control of conveyors, automatic door opening, loop control, hopper and bunker level control, automatic conveyor jamming detectors, etc.

Transistorised automatic lighting control units are coming into use in industry. Photoelectronics (M.O.M.), Ltd.'s automatic lighting control unit is representative. Designed to control both indoor and outdoor lighting, its sensing element is a barrier layer cell in a Bakelite weatherproof tropicalised housing, and through its transistorised amplifier it is capable of switching a load of up to 2 kW.

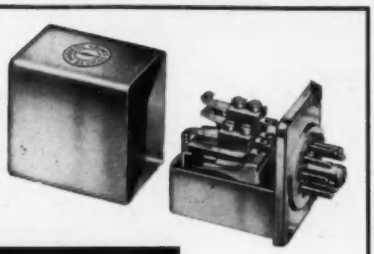
The photo-transistor makes its appearance in another type of industrial equipment—the Avo photo-transistor relay meter, which can be made in various sensitivities and read as a normal instrument. Photo-transistors are mounted at zero and full deflection on the meter scale and receive light from a small external source, directed towards them by light-conducting "Perspex" rods. The meter moving coil carries a "flag" which cuts off the light to the photo-transistors whenever the meter reads zero or full scale. The meter thus can operate an external circuit electronically at each end of its scale.

Another type of process control instrument which has been transistorised is the recycling timer. Venners have produced a type TRT recycling timer employing transistors to switch lamp loads of 12 V, 0·5 A. This is a controller with no moving parts and is such that two lamps may be controlled to switch singly, alternately or simultaneously. This firm also produces a whole range of transistorised units specially developed for process timing control, delay relay applications and sequence timing operation.

Material Treatment Equipment

Because of the power limitations of current transistors, the application of transistors to material treatment equipment has been slower than in process control, where such high powers are not necessary. However, we do find evidence of expansion in this field in such equipment as Photoelectronics (M.O.M.), Ltd.'s flame failure control which operates from a photo-transistor. It is mounted in the blast tube of the burner sighted on to the burner flame, and the control sequence (obtained from a synchronous motor) involves control of lighting and relighting after flame failure. In the material treatment field again, servo-amplifiers play some part, for instance, such transistorised amplifiers as the Pullin packaged servo-amplifier. One interesting application of transistors is their reported use in a completely remote-controlled process of making nitro-glycerine by Imperial Chemical Industries where transistors are believed to be a means of overcoming explosion hazards.

Transistorised indicating and recording apparatus is



Transistorised relay by Magnetic Devices, Ltd.

"Transhailer" transistorised electronic megaphone

Venner transistor power supply unit

becoming increasingly commonplace in industry. Instruments ranging from smoke detectors to vibration meters are available. Radiation monitors and meters are peculiarly suited to transistor operation and currently we find such examples as the Ericsson Telephones gamma ray detector (a portable instrument weighing only 1½ lb which provides visual and audio indication of gamma ray intensity), Fleming Radio's radiation monitor (a breast-pocket self-contained instrument designed to give an immediate, audible and persistent warning to the wearer on entering a radiation-contaminated area) and Philips Electrical's transistorised pocket radiation meter.

Also in the field of indicating apparatus are transistorised meters such as the Soundrite d.c. voltmeter, to measure from 50 mV to 20 kV in six ranges, or the Venner frequency meter. The latter instrument, built from plug-in units, is extremely versatile and is capable of measuring any frequency in the range of 10 c/s to 50 kc/s, and any time interval between two consecutive pulses from the same or independent sources from 0·0001 second to 11½ days, with digital presentation of the results.

We also find transistors used in the Bailey Meters solid material flow failure detector, which gives warning of any interruption in the flow of coal or other solid material in a pipe or chute. Its operation depends on the detection and amplification of the vibration caused by the flow of the material. The same firm produces a transistorised strip chart recorder for temperature and telemetering equipment. In the same sort of application also is the G.E.C. transistorised level-measuring unit for aircraft liquid oxygen containers.

Further instances of the use of transistors in the indicator field are such diverse applications as the Tolimit Gauges air gauging system (using a back pressure balanced air circuit of the manometer liquid-column type, combined with a photo-transistor-operated relay switching system) and the Venner micro- and milli-second stopclocks (constructed from transistorised packaged stages with a transistorised crystal oscillator basic time reference).

Transistors make very satisfactory oscillators and several commercial instruments have made an appearance. Venners produce an LC oscillator and a crystal-controlled oscillator in their range of packaged transistor units; the G.E.C. showed a packaged transistor oscillator at the 1958 I.E.A. exhibition; and Dawe Instruments market a 50 c/s portable frequency standard, which is basically a transistor-maintained vibrating reed of high stability.

Power Supplies

In d.c.-d.c. convertors and d.c.-a.c. invertors, transistors operate more efficiently at low power levels than mechanical rotary or vibrator equipment, and transistorised d.c. high-voltage power supplies are becoming increasingly common in the industrial sphere. Commercial examples of these are the Elliott range of d.c. convertors to supply up to 100 W at 230 V, and the d.c. convertors by W.S. Electronics.

The transistor also operates efficiently as a current regulator and finds industrial applications in this way in Servomex Controls' fully transistorised regulated d.c. supplies or in Venner's transistor stabilised power supply. More complex power supply applications of transistors are exemplified in the Brush Electrical alternator with a transistorised automatic voltage regulator, and the G.E.C. fluorescent lighting d.c.-a.c. invertor designed to operate fluorescent lighting from completely static equipment.

In the field of communications and sound reinforcement a number of firms produce transistor amplifiers that find their way into industrial equipment. W.S. Electronics market both sub-miniature and 12 W power amplifiers, while Pye produce an excellent 10 W (PTC 1010) general purpose amplifier working from 12 V d.c.

Examples of more specialised amplifier equipment are found in the well-known Pye "Transhailer," a fully portable robust loudhailer with self-contained power supplies, giving a maximum output of 3·5 W and weighing only 5 lb. Again, transistorised paging systems are finding their way into industry, and speech reinforcement at noisy telephone points is being covered by transistor amplifiers.

Two-way radio sets in trucks can increase speed of operation; transistorised transmitter-receivers for such purposes have already been produced in the United States by Motorola, and are likely to spread to this country.

Finally, industry is seeing more and more the transistorised tape recorder, which is of truly portable dimensions and designed to facilitate the recording of information in industry and commerce. A good example of this type of equipment is the Dictaphone model now made and sold in this country.

Conclusions

In what has been written above, no attempt has been made to assess the extent to which transistorised computers have found application in the industrial field. Automation implies the use of computers in some cases and we shall probably see an extending use of transistorised computers. Much work is being done in this respect, but its impact may be somewhat delayed, and this article has been devoted principally to describing some points at which the transistor is immediately noticeable to the industrial "man in the street."

In summary, it would appear that in the United Kingdom until now the application of the transistor to industrial purposes has not been so spectacular as its application in some other fields such as hearing aids, portable radio sets, computers and guided missiles. The principal reason for this is probably that industry generally has no great call for very portable, battery-economical equipment, for which the present transistor is best suited. But more than this, transistors, until the last year or two, have not been freely available and there has been no easily accessible codified body of transistor circuitry information. Adequate supplies and increased power and voltage ratings will lead to some increase in the industrial use of transistors no doubt, but with the transistors at present available there is unlikely to be an immediate vast expansion in this field of application.

Long-Distance Waveguide Transmission

A CONVENTION on long-distance transmissions by waveguides was held at the Institution of Electrical Engineers in London recently. Mr. G. Millington presided at the opening session and an introductory survey of the subject was made by Professor H. E. M. Barlow, Pender Professor of Electrical Engineering, University College, London. In the afternoon there was a session on control and performance under the chairmanship of Mr. J. Brown, when some seven papers were presented. Professor A. L. Cullin took the chair in the evening when seven papers on measurement techniques were presented and discussed.

On the following day Mr. L. Lewin presided and ten papers on special microwave equipment were delivered. The final sessions of the convention were devoted to construction and the various aspects of possible long-distance waveguide transmission systems.

Contractors and the Industry

SPEECHES AT THE E.C.A. ANNUAL DINNER

MR. HARMAR NICHOLLS, Parliamentary Secretary, Ministry of Works, was the principal guest at the annual dinner of the Electrical Contractors' Association held at Grosvenor House on 10th February and attended by nearly 700 people. In proposing the toast of the E.C.A. and its allied associations, he mentioned the part played by the contractors in the remarkable expansion of the electrical industry and commended the Association upon its apprenticeship system. There had been differences of views about this, but the fundamental thing was that young men were being encouraged to learn their trade and to be proud of it. Emphasis upon safety in installation work was justified, but too much insistence on possible danger was harmful.

Mr. Nicholls considered that Great Britain was in a much better position than some other industrial countries. He also defended the "profit motive"; a profit could be made only if the sellers produced what people wanted at a price which they could afford.

Mr. C. C. Hyams, president, responded to the toast and in a reference to the Ministry of Works said that although the element of control exercised on the building industry was not now so onerous, electrical contractors wondered whether the burden imposed on them by having to prepare returns was justified. Mr. Hyams reminded the Minister that although electrical contracting was an important factor in building work their contracting and retailing activities were integral parts of the electrical industry as a whole. Their everyday work took them into the field of production since their service was vital to the production drive and to export trade. Moreover, they were "exporting" electrical installations as such for many members were developing a substantial overseas business. He considered that the provisions of the

1. Messrs. Harmar Nicholls and C. C. Hyams (president). 2. Messrs. H. V. Pugh and C. T. Melling. 3. Mr. A. V. Milton and Sir Josiah Eccles. 4. Col. C. W. G. Walker and Sir Henry Self. 5. Mr. C. R. King, Sir Henry Self, Mr. A. H. Carmichael and Mr. L. C. Penwill (director and secretary). 6. The President (centre) with Messrs. E. J. Skinner and P. H. Belder. 7. Messrs. C. G. Plucknett, H. S. Wathes and V. J. Stock. 8. Messrs. L. C. Penwill, H. Riley and P. B. Etheridge. 9. Messrs. R. L. Booth, H. S. Wathes and W. T. Trace. 10. Four past presidents: Messrs. A. V. Milton, S. L. M. Barlow, R. A. Marryat and S. N. Watkins

Restrictive Trade Practices Act were the very negation of those fair trading practices upon which the industry's strength had been built up.

There had recently been tremendous sales of electrical appliances but he wondered whether the capacity and safety of the installations to which they were connected were given sufficient attention. Throughout its existence the E.C.A. had vigorously pursued its primary objects—the safety of the public and sound electrical installation practice. But they were bedevilled by the unrestricted freedom of the "kerbstoner" who lacked responsibility and seldom possessed the necessary knowledge and equipment with which to carry out the work effectively. He did not necessarily advocate legislation to curb the "kerbstoner," but it was a problem which the Government would have to consider in the not-too-distant future.

After expressing his appreciation of the relationships with the Ministry of Works, Mr. Hyams asked the Minister to consider the present situation in which the electrical contractors were subject to conditions of contract which might be satisfactory to the main building contractor but were quite inapplicable to themselves.

Fair Trading

The toast of the guests was ably proposed by Mr. V. J. Stock who, in the course of his remarks, criticised the way in which trade associations were harried by recent legislation. He said that fair trading was not a means of obtaining extortionate profits but a way of ensuring that discounts went only to the people who were entitled to them. He went on to say that the Press reported the dreadful things the Communist-led Electrical Trades Union did, but when the Association took a stand nobody seemed to be interested.

Welcoming Mr. Harmar Nicholls, Mr. Stock expressed the hope that the Ministry of Works would set an example by dealing directly with specialist trades instead of placing contracts through the main contractors. Sir Henry Self had been a sympathetic friend to the E.C.A. and the good relations existing between the Association and the electricity supply industry were largely due to him. Mr. E. G. Plucknett had done much to help to build an orderly trading structure and in the same connection Mr. Stock referred to Messrs. T. W. Heather and A. E. Iliffe, who were also present, and he mentioned other distinguished guests.

In replying for the guests (other than the manufacturers), Sir Henry Self (chairman, Electricity Council) said that the greater funds made available to the electricity supply industry for the reinforcement of distribution would benefit electrical contractors. There had been a great improvement in the relationship between supply authorities and contractors, but it was not enough to say "Live and let live"; they must smooth out all differences between them. Electrical contractors must help to improve the load factor of the electricity supply system; they wanted growth but not growth on the peak.

Emphasising the importance of high standards in installation work, Sir Henry said that the electricity supply authorities were supporting the National Inspection Council and had high hopes of it. He assured the contractors that the Electricity Boards would operate their hire-purchase schemes on a commercial basis. The Boards had no monopoly of the business. They were pioneers on the cooker side but they obtained less than 15 per cent of the business in refrigerators and washing machines. They warmly welcomed the co-operation of the contractors in securing more business and the two parties would go forward together in the expansion of the industry.

Mr. E. G. Plucknett (Simplex Electric Co., Ltd.), who also responded to the toast, said that the reduction of purchase tax and removal of hire-purchase restrictions had demonstrated the extent of the pent-up demand. There were indications that new names were appearing in both electrical manufacturing and merchandising. The manufacturer could improve his profit only by improved design, better methods of marketing and a lower cost of distribution. As to retailing, the public would buy where it could see the best selection, obtain advice, and be assured of the best after-sales service. Was the average electrical retailer equipped to take full advantage of the expansion, remembering that there were other channels? Manufacturers could do much more to ensure that their appliances did not by-pass the legitimate retailer; the latter should shoulder his responsibility or he would lose business to others. Safety of the user was the first consideration of a good manufacturer and it was galling to see shoddy apparatus sold. There should be some mark of approval or guarantee to guide and protect the purchaser. New specifications to cover safety and durability were needed. The same considerations applied to installation work in which there was price-cutting. It was essential to stabilise the trading structure.

Mr. Plucknett said that although conditions had been adverse for both manufacturer and contractor, the outlook was now encouraging. By co-operation and fair trading the industry would make its contribution to the country's economy and to overseas trade.

The president's health was proposed by Mr. A. J. Redbourn (Brighton) and Mr. Hyams briefly replied.

I.C.I. Manufactures Silicon

A LARGE-SCALE development plant has been brought into operation by Imperial Chemical Industries, Ltd., for the manufacture of high-quality silicon of semiconductor grade, the use of which material has increased greatly during the past ten years in the electronic field for the manufacture of semiconductor devices for rectification and amplification. Such devices are much smaller and lighter than conventional radio valves and their life, depending neither on a heated filament nor on a vacuum, is likely to be much longer. Moreover, their power requirements in use are negligible.

Examples of important applications are in rocket equipment, in electronic computing machines, which at present contain several thousand valves, and in smaller items of electrical equipment such as portable radio and television sets and hearing aids. The use of silicon rectifiers enables much valuable space to be saved in power stations and on traction vehicles.

Germanium is also used in semiconductor devices, but silicon is becoming the preferred material. It has greater stability at elevated temperature and in addition it has a higher reverse voltage rating and operates with much smaller reverse currents.

Although compounds of silicon are the main constituents of the earth's crust, the pure element required for semiconductors is expensive. Silicon is normally required in lump form for crystal pulling and in rod form for zone refining. I.C.I. can supply silicon in either form. Lump silicon, p-type, of resistivity greater than 200 ohm/cm, is now available in quantity. Silicon in rod form for zone refining, deposited direct from vapour and of exceptionally low boron content, is being produced in limited quantities in lengths of 24in and diameters up to 1in. If the future market requires it, I.C.I. is prepared to supply silicon in rod form already zone refined into single crystal rods. To date, much of the silicon used in Britain has come from America or France. Now the English organisation will be able to satisfy the demand in Britain and, at a later stage, expects to enter the export field.

Discrimination Between H.R.C. Fuses

Author's summary of a paper which was presented to the Utilisation Section of the Institution of Electrical Engineers on 12th February. It will be published in Vol. 108, Part A of the "Proceedings" of the Institution

By E. JACKS, A.M.I.E.E.*

ONE of the fundamental requirements of electrical protection is discrimination. Its purpose is to localise the effect of a fault, enabling the remainder of the system to function without disturbance. High rupturing capacity fuses have been fulfilling this requirement for many years, but the increasing demands for even more effective protection, particularly on industrial systems, have led to a re-examination of the factors involved. In this paper the author has reviewed the factors upon which discrimination depends and has related these to the requirements of current practice. The treatment of the subject is on a practical basis, from the user's point of view, and the object of the paper is to indicate how the maximum advantage can be obtained from the modern designs of h.r.c. fuses now available.

Fuse Operation

The factors upon which discrimination depends fall under two general headings, those inherent in the fuse itself and those independent of the fuse. The former requires a knowledge of the way in which fuses function under various short-circuit or overload conditions and the latter involves an appreciation of circuit arrangement, and the conditions under which fuses work in service. The operation of a fuse involves two significant quantities: the energy required to melt the fuse element and the energy dissipated in the arc which results from the rupture of the element. In conventional fuse terminology these are referred to as the pre-arcing energy and the arcing energy respectively, the sum of the two being the total operating energy. For discrimination the total operating energy of the minor fuse of two fuses in series must not exceed the pre-arcing energy of the major fuse. The paper explains how these factors are evaluated in practice and shows that the mode of operation of the fuse at the higher short-circuit currents requires different treatment from that for the lower values.

It follows that there are two zones of operation, those involving low prospective currents which produce pre-arcing times longer than 0·02 sec, and those involving high prospective currents which produce fuse pre-arcing times shorter than 0·02 sec. To make the correct choice of fuses for discrimination, data are required relating to both these conditions, although it is shown that if the choice is made to cater for the latter the former is automatically satisfied. Certain approximations are permissible to avoid unwieldy complication and to enable a choice to be made within the bounds of practicability. For the longer operating times—i.e. at the lower fault currents—the data may be presented in the form of the already familiar time/current characteristics, while for the shorter times an indication of the pre-arcing and total operating energy values are required for fuses of each current rating. The determination of actual energy values is not practicable nor is it necessary for ordinary purposes. A comparison between any two fuses based upon the product of time and current squared, integrated from type test oscillograms, is quite adequate and can be supplied by the manufacturer from data at his disposal. With this information, discrimination can be obtained by ensuring that the total operating I^2t of the minor fuse does not exceed the pre-arcing I^2t of the major fuse for any given situation.

Other factors inherent in the fuse itself are accuracy of manufacture and non-deterioration. Both are important because a satisfactory fuse must of necessity be faithful to published characteristics when it leaves the manufacturer's works and to ensure discrimination must remain so throughout its service life. By its nature it cannot be rechecked for accuracy of characteristics nor can it be recalibrated. Proving tests on a considerable scale have shown that h.r.c. fuses can and do fulfil the requirements of discrimination and that their behaviour can be accurately predicted.

The arrangement of fuses with respect to the layout of the system in which they are included can influence discrimination to a large degree. This and other external factors, including temperature considerations, must be taken into account but their effect is not critical and can be easily overcome if considered in the planning stages of the installation. Branching circuits of the type usually associated with supply networks or industrial installations come well within the capabilities of the modern h.r.c. fuse. Fuses can be applied to give any desired degree of discrimination consistent with the importance of the circuit and where for overriding reasons the highest degree is not practicable there is no difficulty in assessing the results which may be expected from any particular arrangement.

The really important point which emerges is that the modern h.r.c. fuse is an accurate device which permits the use of precise data. Its performance can be accurately predicted for any situation where the circuit and site conditions are known, and this remains stable throughout the life of the fuses which may be of the order of 25 years before a fault occurs in the particular circuit in which they are installed.

The author thanks the English Electric Fusegear Division for permission to use information published in the paper.

DISCUSSION

The discussion was opened by Mr. G. E. Skillington (Unilever, Ltd.), who drew attention to the recommendation in B.S. 88:1952 incorporating an amendment issued last May (a mine of information on fuses) that specific information should be sought from manufacturers on discrimination, in view of the complexity of predicting it. He derived considerable satisfaction from the fact that fuse designers and manufacturers were making a determined effort to provide sufficient information to enable the user to employ cartridge fuses to the best advantage.

* Mr. E. Jacks is the chief engineer of the English Electric Fusegear Division.

With regard to terms and definitions, he expressed the view that the correct descriptive words were "high breaking capacity" and not "high rupturing capacity." He urged the amendment of the B.S. in this respect.

Mr. T. B. Rolls (McLellan & Partners) said that B.S. 88 did not exactly wax enthusiastic about h.b.c. although it took a somewhat dim view of h.r.c. He regarded the paper as a challenge to see how far cartridge fuses could be used to the exclusion of circuit-breakers, though he hoped he would not suffer suppression from the author's circuit-breaker-making colleagues!

Importance of Correct Use

Major H. E. Knight (Stewarts & Lloyds) thought there was great need to educate users: these fuses afforded back-up protection and must not be used as they so often were as overload devices. This defeated the whole object of a well-planned system. A great deal depended on the individual layout and he felt that much of the research done by manufacturers was nullified by the varying types of insulation still existing in industry. He recommended that all fuses should be inside the manufacturer's fuse carrier and urged that more work should be done on the protection of d.c. circuits by h.r.c. fuses.

Mr. J. R. Anderson (Crompton Parkinson) asked whether it would be possible to design a simple system of notation of fuses so that the average works electrician would know which would discriminate with which. He said that in the early days his company had gone in for cartridge fuses in consumer units, but damage was caused by people indulging in makeshift replacements and they had had to resort to rewirable fuses. It would be valuable if the paper could be extended to cover these fuses.

Mr. R. H. Dean (Parmiter, Hope & Sugden, Ltd.) challenged the author's statement that the principal duty of the fuse was to interrupt short circuits and that discrimination was a secondary requirement. The duty of a fuse in his opinion was to protect the apparatus from faults. He asked Mr. Jacks whether he could give any information as to discrimination by time-lag fuses as compared with silver-wire fuses.

Mr. W. J. Elliott (General Electric Co., Ltd.), commenting on a question by a previous speaker as to why consideration was not given to discrimination with the lower currents, said he thought this was because it was normally obtained from a comparison of the time/current characteristics. He thought it might be more convenient to users if the time/current characteristic could be extended to give the whole of the answer to the problem of discrimination. This could be done by means of the virtual time method. The author had cast some doubt on its advantages and it did require some understanding but he himself preferred it to I^2t in comparing discrimination curves.

Mr. H. Simmonds (English Electric Co., Ltd.) expressed the view that it was the discrimination of h.r.c. fuses that had brought them into such widespread use. He had had experience of them dating back for many years and knew of few complaints about non-discrimination.

Mr. J. W. Gibson (Line Equipment, Ltd.) said he agreed with Mr. Elliott about virtual time. He thought more data would be useful on tolerances which so often depended on the optimism or pessimism of the manufacturer. Most manufacturers liked to think they could improve on the ± 20 per cent in the high-voltage specification but it would be useful to have a figure in the British Standard.

Mr. H. W. Baxter (E.R.A.), referring to Figs. 6 and 8, questioned whether "prospective current" was the right term. It was introduced a good many years ago in connection with the breaking capacity of the fuse, but it really related to the circuit. A better expression might be "virtual current" because it was not the prospective current but the actual current flowing through that was responsible for blowing the fuse.

The new optic for the Eddystone Lighthouse which is soon to replace the original mechanism installed in 1882. The apparatus, shown here at the works of the manufacturers, Stone-Chance, Ltd., will form a part of the special lighthouse display at the forthcoming Electrical Engineers' Exhibition (Earls Court, 17th–21st March)

M.Sc. Course in Information Engineering

SUITABLY qualified students (preferably with some industrial experience) can qualify for the degree of M.Sc. at Birmingham University on satisfactory completion of a 12-month course in information engineering of which the next session runs from 1st October, 1959, to 30th September, 1960. Subjects available cover communications, radar, computers and control systems, with some degree of choice to suit individual requirements.

It is sometimes possible to admit to courses of lectures on individual topics, engineers who can be seconded from industry for a period of five weeks only. The award of the degree of M.Sc. to students successfully completing the course is intended to be a guarantee that the course is at a high level. Many members of the University Electrical Engineering Department have been for some time engaged in research in various topics relevant to this course, and the projects on which students work during the final three months of the course are normally associated with this research. It has proved possible for students to make a definite contribution to the Department's published research by means of their three-month projects. Particulars of the course can be obtained from the Electrical Engineering Department, the University of Birmingham, Edgbaston, Birmingham, 15.

GENERATION and DEVELOPMENT

Nuclear Power Station Site Investigations

The Central Electricity Generating Board proposes to carry out detailed investigation of two areas on the central south coast to see how far they offer the necessary facilities for nuclear power stations. These are at Earnley, in West Sussex, and at Hamstead, in the Isle of Wight. There is an urgent need to explore ways of expanding power generating capacity in this area to help meet the constantly growing demand for electricity both in the coastal towns on the southern seaboard and in the counties inland.

The investigations will include ground surveys, trial borings and hydrographic surveys and will take several months to complete. Any proposal to build a nuclear power station that might arise from these investigations would be submitted to the Minister of Power and the planning authority in the usual way.

C.E.G.B. Bristol Offices

Amended plans for a new office block at Oakfield Grove, Clifton, Bristol, for the Central Electricity Generating Board have been approved by the Bristol Planning and Public Works Committee. The scheme provides for a four-storey office block and a basement car park.

Domestic Appliance Sales in 1958

The latest return issued by the Electricity Council shows that sales of all the main types of domestic appliances by Area Boards were higher last year than in 1957, in most cases appreciably. This was directly attributable to the removal of controls on hire-purchase and credit sale agreements in September and October, the effect of which can be judged by comparing the monthly and annual rates of increase. Wash boiler sales alone have remained almost stationary, no doubt due to the rise in popularity of the washing machine. In 1957 80,513 wash boilers were sold by Electricity Boards, compared with 73,545 washing machines, while last year the respective figures were 80,764 and 103,788. The electric refrigerator was already gaining in public favour before the relaxation of controls provided a stimulus to sales; now it has the highest rate of increase of any of the main types of electrical appliances. More were sold in December than in the whole of the last quarter of 1957.

The figures given in the accompanying table relate to Area Boards in England and Wales and represent, of course, only a part of the total sales throughout the country.

275 kVA Switching Station

Glasgow Corporation has approved a planning application submitted by the South of Scotland Electricity Board for the erection of a 275 kV switching station at Castlebay Street.

Electric Road Heating

To prevent ice formation in cold weather, electric road heating has been applied to a stretch of steep hill (gradient one-in-four) at Bath with excellent results. This is the first installation of its kind in the West Country. The electrical installation was completed in three days. A 50ft stretch of steel mesh was laid 2½in below the road surface, which then was covered with a carpet of waterproof tarmac. Low-voltage current was then applied to the mesh as a heating element. It was found that the temperature of the road surface rose from freezing point to 48 deg F within a few hours. At present manual switching is provided for the scheme, but arrangements are being made for automatic operation later on. The electrical loading is 9·3 kW, or 13·8 W per sq ft of heated surface.

OVERSEAS

Canadian Power Output

At a Press conference in Montreal recently Mr. V. A. Ainsworth, president of the Canadian Electrical Association, said that electric utilities in Canada generated 75,200 million kWh in 1958, an increase of 5·5 per cent over the preceding year. In addition industrial plants generating their own power produced 21,200 million kWh, making a total of 94,400 million kWh. This compares with 90,200 million kWh in 1957.

A record amount of new generating plant was brought into service, new hydro-electric installations totalling 1,954 MW and thermal plant over 500 MW. The largest previous addition was in 1954 when 1,430 MW was installed. The aggregate capacity of the country's generating stations is now 18,600 MW.

Quebec Commission's New Headquarters

Plans have been approved for a new 24-storey headquarters building for the Quebec Hydro-Electric Commission. A feature of the building will be an underground substation, planned in anticipation of increased demands for power in the mid-town area. This will be a three-storey structure with a plant capacity of 450 MVA. Power will be received at 120 kV for distribution through 12 kV and 4 kV feeders. Losses from the transformers will heat the building, eliminating the necessity for a boiler room. An auxiliary heating service will be available for particularly cold periods.

N.S.W. Power Station Contracts

Contracts worth £14¼ million have been let for the construction of the New South Wales Electricity Commission's proposed power station at Vales Point. The power station, on the southern shore of Lake Macquarie, is being planned for an ultimate capacity of at least one million kilowatts—nearly three times the size of Bunnerong. The contracts cover the civil engineering and building work and the boilers for the first two 200 MW generating units scheduled for operation before the winters of 1963 and 1964. The boiler contract for £7½ million has been let to International Combustion Australia, Ltd., and the civil and building contract for £6¾ million to Arcos Industries Pty., Ltd., in conjunction with Thiess Bros. Pty., Ltd. A separate contract for the two 200 MW turbo-generators, the largest yet ordered by the Commission, is being considered. More than 50 per cent of the boiler plant will be of Australian manufacture. The boiler drums and other special items of heavy equipment will be supplied by the parent company in Great Britain. The boilers will be of the semi-outdoor type with a capacity of 1,350,000 lb/hr and will operate at 2,450 p.s.i.g., 1,055 deg F, with reheat to 1,005 deg F.

Argentina Advised to Postpone Nuclear Plans

Lord Chandos, chairman of the A.E.I., said during his visit to Argentina last week that he had advised President Frondizi to postpone the installation of nuclear plants for the time being. "The longer that Argentina waits the more it will benefit from experience elsewhere." He also pointed out that though at present the capital costs of conventional stations were half those of nuclear stations, by 1968 nuclear power would be cheaper than conventional power.

ELECTRICAL APPLIANCE SALES BY AREA BOARDS

Type of Appliance	Sales in month ended 31st December		Sales in year ended 31st December	
	Total	% change over corresponding period of previous year	Total	% change over corresponding period of previous year
Cookers	29,828	+ 50·1	263,033	+ 14·3
Water Heaters—				
Immersion	7,344	+ 32·8	163,469	+ 16·4
Storage	4,440	+ 45·8	49,266	+ 18·3
Wash Boilers	5,687	− 1·5	80,764	+ 0·3
Washing Machines	16,642	+ 216·6	103,788	+ 41·1
Refrigerators	7,170	+ 294·2	75,182	+ 50·3

NEW ELECTRICAL EQUIPMENT

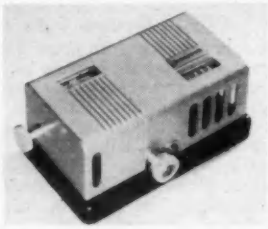
Ceramic Coffee Percolator

A new ceramic coffee percolator, the "Warwick," has been added to the range of electric coffee percolators manufactured by BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk. From 1¼ to 2½ pints of coffee can be made at one time. A 500 W element is fitted and a safety device automatically operates if the percolator is allowed to boil dry. Models are available for the 200/220 and 230/250 voltage ranges. The body is finished in a wide range of attractive shades, including pink, blue, green, primrose and dove grey, with black lid and matching base. The price is £4 12s 6d, including purchase tax.

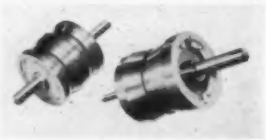
Best Products "Warwick" coffee percolator

Heating-system Thermostat

A thermostat for heating systems incorporating unit heaters and forced air convectors, with an additional fan operating control, has been announced by HONEYWELL CONTROLS, LTD., Ruislip Road East, Greenford, Middlesex. The thermostat, which is suitable for loads up to 4 kW, has a three-position manual control with a locking device to prevent unauthorised operation. A purely automatic version is also available, and both types can be supplied with a built-in thermometer if required.



Honeywell thermostat



Rapid Magnetic Machines conveyor rolls

Magnetic Conveyor Rolls

A range of concave magnetic conveyor rolls has been announced, augmenting the standard range of equipment manufactured by RAPID MAGNETIC MACHINES, LTD., Lombard Street, Birmingham, 12. These rolls are obtainable in two diameters, 15in for conveyor loads up to 3in diameter, and 18in for loads up to 6in diameter, and double rolls are available if required.

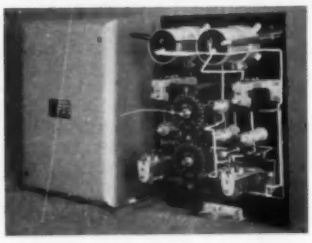
Westool sparkless switch unit

Sparkless Switches

A range of sparkless switches for operation where pollution, fire or explosion risks are present is being manufactured by WESTOOL, LTD., of St. Helen's Auckland, County Durham, under licence from Imperial Chemical Industries, Ltd. No springs are incorporated in the switches, which consist of a mercury tube mounted on an insulated carrier held on a spindle bonded in rubber to an anchor ring. A plate is fitted to this ring which determines the function of the switch, providing either a latching effect when used for lighting or for other applications where a positive "on" position is required, or non-latching when used to replace a push-button control for remote operation.

The switches, which can be supplied in dustproof enclosures with shields and engraved plates, are rated at 15 A 240 V or 8 A momentarily and 1 A continuously when used on 440 V supplies. The prices of the basic switch unit range from 63s for a single-pole non-latching type to 125s for a four-pole latching type. Completely enclosed switch unit prices range from 115s for a single-pole single-gang non-latching unit to 728s for a four-pole four-gang latching unit.

Motor protection relay unit by Londex



Protection Relay Units

Two relay units giving protection against phase failure or under-voltage in a motor supply have been produced by LONDEX, LTD., Anerley Works, 207, Anerley Road, London, S.E.20. The type LF/PF is suitable for single-phase or three-phase four-wire systems up to 440 V. For three-wire systems a resistance unit providing a dummy neutral is available. Two sets of contacts can be provided, rated at 4 A 250 V a.c., on each of the relays incorporated. A second unit, the type KR/PF, can also cater for three-phase three-wire systems with a maximum of 550 V a.c. The unit is normally set to operate at an under-voltage figure of 15 per cent and to automatically reset at 98 per cent.

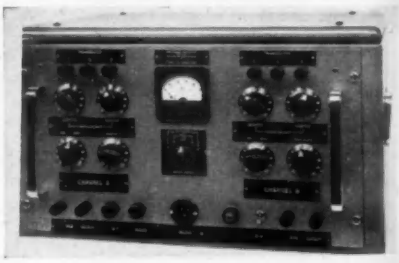
Magnetic Counter

A magnetic perception head is incorporated in an equipment developed by GATE ELECTRONICS, LTD., Tudor Grove, London, E.9, for counting metallic objects of any size passing along a conveyor belt, or for making length measurements on any continuous metallic product displaying regular profile variations. An electro-mechanical counter recording up to 20 items per second, is fitted, but if required an electronic unit may be incorporated with a counting rate up to 1,000 items per second.

High-Sensitivity Detector

Two pen recorders simultaneously measuring, in conjunction with existing transducers, differences in weight and pressure of liquids and gases are operated by the type 14481 bridge and detector announced by P.A.M., LTD., Merrow, Guildford, Surrey. Facilities

P.A.M. type 14481 detector



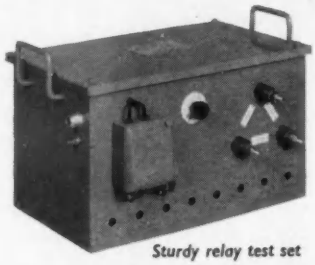
are incorporated for balancing the bridge with the transducers in circuit, and for setting the working point of the output, and pen zero. Calibrated controls on the front panel allow rapid setting up of both the transducer and bridge, and the recording sensitivity.

Relay Test Set

The relay test set manufactured by the STURDY ELECTRIC CO., LTD., Hamsterley Colliery, Newcastle-upon-Tyne, for testing over-current release coils of mining and industrial type switchgear consists of a self-excited transductor unit contained in a portable case having approximate dimensions 20in long by 13in wide by 11in deep, and weighing 81 lb. The single control gives a continuously variable output current over three ranges, 30 to 240 A at 4 V, 15 to 120 A at 8 V and 10 to 80 A at 12 V.

The equipment, which may be short-circuited without causing damage, may also be used for applications where a source of current is required at low voltages, including testing wire fusing currents, cable heating and de-icing water pipes.

The standard equipment is arranged for an input of 250 V, single-phase, 50 c/s, but sets suitable for connection to other supplies are available. The price of the standard equipment is £48 and delivery can normally be made in 2-3 weeks.



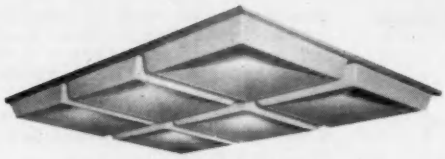
Sturdy relay test set

Electric Counter

The type 100 range of electric counters manufactured by COUNTING INSTRUMENTS, LTD., 5, Elstree Way, Boreham Wood, Hertfordshire, has now been extended to include a dozens counter, the first wheel being engraved with the figures 0 to 11. Models operating on d.c. supplies are priced at £7 10s each, and those on a.c. supplies at £8 5s each, with delivery in six to eight weeks for both types.

Suspended Ceiling Fitting

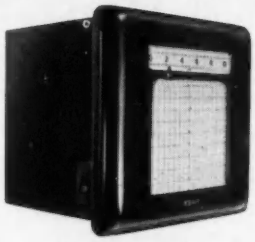
The "Brite-Glo" suspended ceiling now being marketed by COURTNEY, POPE (ELECTRICAL), LTD., Amhurst Park Works, Tottenham, London, N.15, is designed principally for domestic interiors, in particular kitchens and bathrooms, but also has applications in shops, stores and offices. It is supplied as a packaged unit, available in two standard sizes, 6ft by 4ft with 2ft square plastic diffusers and 9ft by 6ft with 3ft square diffusers, supported in a metal "T" frame. Other frame sizes can be made to suit special requirements. The unit is designed for use with fluorescent lamps which are fixed on the structural ceiling, the "Brite-Glo" ceiling being suspended underneath by chains. It is supplied complete with simple fixing instructions, and the price will be less than £20.



"Brite-Glo" suspended ceiling fitting (Courtney, Pope (Electrical), Ltd.)

Electronic Recorder

The Mark 3 "Multelec" high-speed electronic strip-chart indicator-recorder announced by GEORGE KENT, LTD., Luton, Bedfordshire, is at present available for the measurement of millivoltage, and also temperature, when used in association with a thermocouple, resistance thermometer or radiation pyrometer. The 10in wide chart moves at speeds from 1in per hour to 4in per minute, and the pen requires only 2 seconds for full scale travel. The recorder is available in single- or multi-point form, with point-cycle times of 5, 10 or 20 seconds, enabling up to sixteen variables to be measured and recorded consecutively.



Kent chart recorder

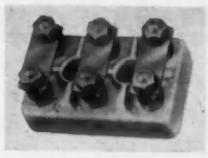
Magnetic Alloy

A cobalt-platinum magnetic alloy, Platinax II, produced by JOHNSON, MATTHEY & CO., LTD., 73-78, Hatton Garden, London, E.C.1, contains 23·3 per cent by weight of cobalt. In the heat treated state the alloy is magnetically isotropic, exhibiting similar magnetic properties in all planes, and it can readily be machined, rolled and drawn, facilitating the manufacture of complicated or small magnets.

A sintered material composed of tungsten, nickel and copper, Mallory 1000, is also announced, suitable for the radiation shielding of neutron-emitting fission by-products.

Connector Block

A 3-way 60 A connector block with 0 BA size terminals is announced by NETTLE ACCESSORIES, LTD., Warren Street, Stockport, Cheshire. The base is of electrical grade porcelain, and an insulating backing plate is supplied to ensure adequate clearances from the mounting surface.



Nettle connector block

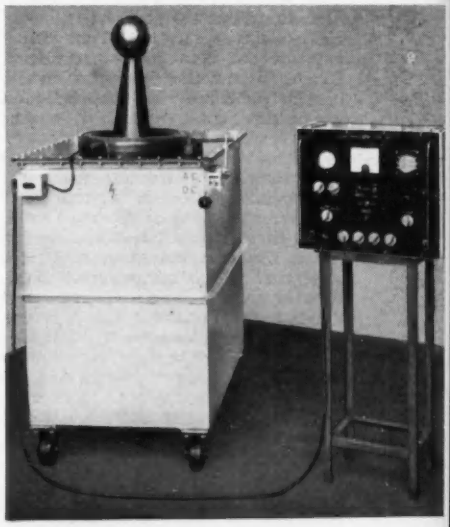
Flash Tester

The high voltage flash tester type P.200, introduced by AIRMEC, LTD., High Wycombe, Buckinghamshire, for testing insulating materials and component dielectric incorporates a sensitive indication of ionisation and leakage currents in addition to providing a heavy breakdown current. A continuously variable output from 0 to 140 kV peak a.c. at 50 c/s or 0 to 140 kV d.c. is obtained from a unit housed in a steel, oil-filled case.

A control unit, installed up to 36ft away and electrically isolated from the e.h.t. source, contains a meter for measuring a.c. or d.c. output voltages and leakage currents up to 5 milliamps. A 2¾in cathode ray tube is also incorporated for displaying leakage currents or applied voltage waveforms and ionisation currents, and audible indication is also given if ionisation currents flow.

Breakdown or flashover is indicated by a neon tube, and a thermal overload switch in the control unit operates if the test piece maintains full load for an appreciable time, resetting after a short period. The equipment operates from a 200-250 V 50 c/s a.c. power supply and has a total consumption of 1 kVA on full load.

Airmec 100 kV flash tester



Financial Section

STOCKS and SHARES

ENGLISH ELECTRIC are again one of the most prompt of the major industrial firms to produce their financial results for the past year. The announcements gave a good start to the season of reports and dividend declarations which will bring a growing volume of company news over the next two or three months. While the maintenance of English Electric's dividends at a total of 14 per cent, as before, and the increase in net profits (before tax) from a little under to just over the £7 million mark were in line with expectations, the proposed distribution of a one-for-two scrip issue came as an agreeable surprise: it would account largely for the subsequent rise in the price of the £1 shares to 62s 6d. At this level they are showing a yield of 4½ per cent. The 1·8 million new ordinary shares issued at the beginning of this year do not rank for the 1958 dividend. At the time of this operation the directors expected, with the usual reservations, that it would be possible to repeat the 14 per cent dividend on the larger capital which will participate in payments for this year.

Dividends Due

Associated Electrical Industries usually publish their preliminary statement on the year's results, together with the final dividend declaration, within a week or so of English Electric's announcements. Last time they appeared in the first week of March. The A.E.I. shares issued to London Electric Wire shareholders in connection with the merger will not participate in the coming final dividend. Hoover is another company which usually publishes the annual figures within about two months of the closing of the books. Half way through 1958, profits of the group were said to show a very satisfactory increase over the corresponding previous figures. The £1 shares have risen 3s 6d, to 62s. Last year Midland Electric Manufacturing results appeared at about the same time. This company has distributed a two-for-three scrip issue since the last distribution of 12½ per cent, which was supplemented by a jubilee bonus of 2½ per cent. The directors have forecast a 10 per cent dividend on the enlarged capital. An announcement is due shortly also from Taylor Tunnicliff.

Cable Shares

Industrial markets of the Stock Exchange have been showing no very decided trend. Among electrical issues, the English Electric results induced firmness in the shares of the other big groups. Cable manufacturers' shares continued to monopolise a good deal of attention. Rumours were busy again with Enfield Cables and Enfield Rolling Mills, which reacted rather sharply at one time to 20s and 44s 6d respectively. On the other hand, Johnson & Phillips returned to prominence with a rise of 3s to 25s 6d, while Scottish Cables at 15s 9d and Pyrotenax at 35s 6d were also

Price Changes in

Company or Board	Nom. Value	Middle price 16th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	80		3	3	3 15 0	77	72
Brit. Elec. 1974/77	100	76		3	3	3 19 0	73½	68½
Brit. Elec. 1976/79	100	80½	+½	3½	3½	4 7 0	78½	72
Brit. Elec. 1974/79	100	90½	+½	4½	4½	4 14 0	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	16/-		6·8†	7†	15 4 0	17/6	15/-
East African Power	£1	22/-	+6d	7½	8	7 5 6	23/-	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	12/6
Perak Hydro-Elec.	£1	13/6		12½	10	14 16 3	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	15/9		17½	17½	5 11 0	15/9	9/9
Aerialite	1/-	8/3	+3d	51½	54	6 10 9	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	28/9		8	9	6 5 3	29/3	19/9
Aron Elec. Ord.	£1	61/3		15	15	4 18 0	61/3	53/-
Assoc. Elec. Ord.	£1	55/-		15	15	5 9 0	58/9	46/6
Automatic Tel. & El.	£1	80/-		17	17	4 5 0	75/-	57/-
Babcock & Wilcox	£1	48/9		15	13‡	5 6 6	54/6	41/9
Bakelite	10/-	22/9		15	15	6 11 9	23/-	17/6
Baldwin, H. J.	2/-	2/6		20	20	—	3/9	2/6
Berry's Electric	5/-	11/-		10	10	4 11 0	11/3	5/9
Bowthorpe Holdings	2/-	12/-		37½	25*	4 3 4	11/9	6/6
British Elec. Traction: Def. Ord. "A"	5/-	39/6	+2/-	25	25	3 3 3	40/-	19/6
B.I. Callender's	£1	48/-	−6d	12½	12½	5 4 3	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Thermostat	5/-	38/-	−9d	25	30	3 9 0	36/3	19/9
British Vac. Cleaner	5/-	6/3x.d.		10	7½*	6 0 0	4/6	2/3
Brook Motors	10/-	50/-		25	24½*	4 16 9	45/-	27/9
Bulgin, A. F.	1/-	7/-	−3d	40	45	6 8 6	7/-	4/7
Bulpitts	5/-	10/6		—	12½‡	5 19 0	11/-	7/3
Burco Dean	5/-	12/6		22½	16*	6 8 0	12/6	7/9
Cable & Wireless: Ord.	5/-	12/6x.d.	−3d	10	10*	4 0 0	13/-	8/-
4% Loan	100	94½	−½	4	4	4 4 9	94½	89
Chloride El. Storage "A"	£1	67/6	+6d	17½	17½	5 3 9	68/9	55/6
Clarke Chapman	£1	62/6		27½	27½	4 8 0*	72/6	55/-
Cole, E. K.	5/-	18/9		17½	17½	4 13 3	18/-	15/3
Contactor Switchgear	5/-	12/6		20	14*	5 12 0	13/-	9/-
Cossor, A. C.	5/-	7/6		2½	Nil	Nil	7/9	4/4
Crabtree	10/-	29/6		20	20	6 15 6	32/-	24/4
Crompton Parkinson	5/-	12/6		16	12*	4 16 0	13/9	8/3
Davis & Timmins	5/-	15/-		22½	18	6 0 0	16/3	10/3
De La Rue	10/-	32/6		35	17½*	5 7 9	34/-	20/9
Decca "A"	4/-	38/9	+1/3	43½	50	5 3 3	37/6	21/3
Desoutter	5/-	19/9		32½	18½*	4 15 0	19/3	13/6
Dewhurst	2/-	7/6		20	20	5 6 9	9/3	6/9
Dictograph Tel.	2/-	7/6		20	20	5 6 9	7/3	4/7
Dubilier Condenser	1/-	3/6		30	20*	5 14 3	4/3	3/1
Duport	5/-	10/6	+3d	25	12½*	5 19 0	10/9	7/9
E.M.I.	10/-	56/9	+5/3	15	20*‡	3 10 6	52/6	20/9
Electrical Components	5/-	11/6x.d.		12½	12½	5 8 9	10/9	7/-
Elec. Construction	£1	28/9		8½	8½	5 18 3	28/9	21/-
Elliott-Automation	5/-	17/6		—	10‡	2 17 3	19/9	11/6
Enfield Cable Ord.	£1	20/-	−1/3	Nil	2½	2 10 0	18/9	10/9
English Electric	£1	62/6	+3/9	14	14	4 9 6	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	26/3		22†	12*‡	3 17 6	26/3	17/6
Ever Ready	5/-	25/9	+1/-	37½	20*	3 17 9	22/3	13/9
Falk Stadelmann	£1	45/-	+2/6	17½	15	6 13 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

higher. Following the absorption of the Telegraph Construction and Maintenance Company into the B.I.C.C. group, normal dealings have finished in the "Telcon" shares, which have long been a popular investment in the electrical lists. The new B.I.C.C. shares issued in exchange have been quoted at about 46s 6d.

Price Changes

Following some confusion in the market at the time of the announcements, Avo 2s shares were quoted at about 10s 3d after news of an offer from Metal Industries of 10s in cash per share, or of one M.I. £1 share for every four Avo. The M.I. shares eased to 42s. On further consideration of the recently announced annual reports and increased dividends, Decca "A" shares improved further to 38s 9d, and British Vacuum Cleaner remained firm at 6s 3d ex-dividend. Electric & Musical Industries recovered 5s 3d, to 56s 9d, and Philips Lamps approached £5 again. Ward & Goldstone added 1s 6d to the previous week's advance of 3s 6d, reaching 37s, and other improvements include those in Lancashire Dynamo at 43s 9d, Ever Ready at 25s 9d, S. Smith at 12s 3d and Falk Stadelmann at 45s.

Electrical Investments

Company or Board	Nom. Value	Middle price 16th Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Electrical Shares—continued						£ s d		
G.E.C.	£1	32/6		12½	10	6 3 0	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	8/9		24	15	8 11 6	11/9	8/3
Greenwood & Batley	£1	79/6	−1/-	17½	20	5 0 9	57/6	45/-
Hackbridge Holdings	5/-	15/3		20	20	6 11 3	15/3	7/6
Hackbridge & Hewittic	5/-	15/3		20	20	6 11 3	14/6	9/7
Head Wrightson	5/-	26/-	+9d	22½	17½*	3 7 3	26/-	16/9
Heatrae	2/-	9/-	+3d	15	20	4 9 0	7/9	4/-
Holophane	5/-	15/9	−6d	37½	22½*	7 2 9	15/6	12/6
Hoover	5/-	62/-	+3/6	50	50	4 0 9	58/6	31/-
I.C.I.	£1	34/9	+3d	10	12	4 12 0*	37/6	23/9
Intl. Combustion	5/-	33/9	+2/6	25	30‡	4 9 0	28/3	19/3
Intl. Computers & T.	£1	67/6	+1/3	—	8‡	2 7 6	—	—
Johnson & Phillips	£1	25/6	+3/-	10	5	3 18 6	25/-	15/-
Lancashire Dynamo	£1	43/9	+1/3	11	11	5 0 6	45/-	28/6
Laurence Scott	5/-	17/3		15	15	4 7 0	16/9	12/6
Lister, R. A.	£1	37/-	+3/6	10	12½	6 15 3	34/6	23/-
London Elec. Wire	£1	70/-		12½	12½	—	72/-	39/6
Lucas, J.	£1	45/3	+9d	7½	10‡	4 8 6	45/-	27/9
Marconi Marine	£1	46/3	−1/3	10	10	4 6 6	40/-	29/-
Marryat & Scott	2/-	9/-		35	37½	4 3 3*	8/9	5/3
Mather & Platt	£1	48/3	−1/3	15	15	4 3 0*	50/6	29/6
Metal Industries	£1	42/-	−1/9	9	14	6 13 3	44/-	22/9
Midland Elec. Mfg.	£1	42/6		12½	10*‡	4 14 3	41/3	26/6
Morphy-Richards	4/-	18/9		20	20	4 5 3	20/-	14/6
Murex	£1	44/-	−1/-	20	17½	7 19 0	59/3	46/9
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parsons, C. A.	£1	51/3		8½	7½*	2 18 6	55/-	43/-
Plessey	10/-	72/6		30	30	4 2 9	72/6	55/-
Pye	5/-	15/9	+1/6	12½	12½	3 19 3	17/-	10/-
Pyrotenax	5/-	35/6	+6d	—	27½‡	3 17 6	37/-	27/6
Reliance Clifton	5/-	19/6	+2/-	13½	15	3 17 0	19/9	9/-
Reyrolle	£1	91/3		17½	17½	3 16 9	93/9	73/6
Rheostatic	4/-	8/9		12½	12½	5 14 3	8/6	6/-
Richardsons Westgarth	10/-	14/9		16¾	8¾*	5 13 0	15/9	13/-
Scottish Cables	4/-	15/9	+6d	27½	27½	4 1 6*	12/3	7/-
Simon-Carves	5/-	29/6		20	25	4 4 9	31/3	22/6
Smith (England), S.	4/-	12/3	+6d	20	12½*‡	4 1 9	12/3	7/-
Southern Areas	£1	12/9		7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	8/9	+6d	15	15	8 11 6	9/3	4/9
Sturtevant	5/-	17/3		15†	15†	7 12 0	19/6	14/9
Sun Elec.	£1	69/6		25	25	7 4 0	60/6	47/3
Switchgear & Cowans	5/-	11/9		25	22½	4 15 9*	9/9	4/6
Taylor Tunnicliff	5/-	18/3		15	17½	4 16 0	18/3	11/9
T.C.C.	10/-	39/-		25	25	6 8 3	38/6	32/6
Telephone Mfg.	5/-	5/3		10	10	9 10 6	5/9	4/3
Telephone Rentals	5/-	13/-x.c.	+6d	12½	12½‡*	4 16 3	14/6	9/9
Thompson (John)	5/-	23/9		25	25	5 5 3	27/-	23/-
Thorn Elec.	5/-	30/6	+6d	17½	17½	2 17 6	25/-	17/-
Thorneycroft	£1	21/3		12½	7½	7 1 3	30/9	21/-
Tube Investments	£1	81/3	+2/6	15	17½	4 6 3	81/3	48/3
Vactric	5/-	34/6	+1/9	25	25	3 12 6	—	—
Veritys	5/-	2/6	−1/3	12½	2½	—	6/9	5/3
Walsall Conduits	4/-	17/9	+6d	20	22½	5 1 6	18/3	11/-
Ward & Goldstone	5/-	37/-	+1/6	40	25*	3 7 6	37/-	23/6
Watford	2/-	8/-		25	25	5 0 0*	8/-	4/-
Westinghouse	£1	41/3		10	10	4 17 0	45/-	32/3
West, Allen	5/-	12/-		15	12½*	4 17 3‡	13/3	7/9
Wolf Electric	5/-	8/3		20	10*	6 1 3	9/-	6/9

Vactric

Persistent support for Vactric 5s shares has continued to attract attention. They stood at about 26s shortly before the announcement last October of a special tax-free distribution of 8s 6d per share out of the capital profit on the sale of the Awley Finance subsidiary for £1·6 million. They have been quoted lately at about 34s 6d, shareholders having received in the interval not only the cash payment but a one-for-nine scrip issue as well. Later developments have included an increase in the interim dividend for the current year from 10 to 12½ per cent. The interim report for the first half of the year ending in March showed that profits were running at an annual rate well in advance of the preceding year. If the trend were continued, results for the current year were expected to establish new records for turnover and profits. The next results are due to appear in June.

International Combustion

There has been a good response from International Combustion 5s shares to the announcement of the preliminary results for the year ended last September. Already at an advanced level in advance of the news, they have been marked up by a further half-a-crown, to 33s 9d, since the disclosure of an increase of nearly £100,000 to £1·37 million in the net taxed profit, and of a special 5 per cent interim dividend on account of the current year in addition to a final distribution for 1957–8 making a total of 25 per cent, as before. On the assumption that the extra 5 per cent is declared in that form by reference to the change in profits tax, the shares are regarded in the market as being on a 30 per cent dividend basis, which brings up the yield to about 4½ per cent. This is the ninth successive increase in the ordinary shareholders' dividend.

Radio Rentals

Radio Rentals are offering to shareholders £1·6 million new 5s shares, which are being dealt in actively at a premium of around 18s 6d on the issue price of 15s. On the basis of a 20 per cent dividend the yield is 3 per cent.

REPORTS and DIVIDENDS

English Electric Group.—Preliminary figures have been issued of the financial results of the companies in this group for 1958.

The English Electric Co., Ltd., reports a group profit for the year of £7,017,638, as compared with £6,961,578 for 1957, and after deducting £2,919,414 for taxation, and transferring £1,075,100 to reserve (taxation relief on capital allowances in excess of depreciation), the group net balance is £3,017,258 (against £2,951,285). The ordinary dividend for the year is maintained at 14 per cent by a final payment of 10 per cent.

Following the annual meeting in March, an extraordinary meeting will be held to consider resolutions to increase the authorised capital of the company to £35 million and to authorise the directors to issue in May next 10,046,335 new ordinary shares credited as fully paid in capitalisation of £10,046,335 of the amount now standing to the credit of the share premium account, in the proportion of one new ordinary share for every £2 of ordinary stock held.

Marconi's Wireless Telegraph Co., Ltd.—The group profit for 1958, before taxation, is £1,028,519, as compared with £1,107,112 for the previous year, and after providing £559,636 for taxation and transferring £37,100 to reserves (taxation relief on capital allowances in excess of depreciation), there is a net profit of £431,783 (£465,855). A sum of £250,000 is placed to general reserve and the ordinary dividend for the year is unchanged at 10 per cent.

The Marconi International Marine Communication Co., Ltd.—The profit for 1958 is £521,194, as compared with £662,892 for the preceding year, and the net balance, after deducting £234,155 for taxation and £65,000 transferred to capital reserve (taxation relief on capital allowances in excess of depreciation), is £222,039 (against £240,767). General reserve receives £135,000 and the proposed final dividend is 6 per cent, maintaining the distribution for the year at 10 per cent.

D. Napier & Son, Ltd.—After providing £148,000 for taxation, the profit for the year is £94,543, as compared with £91,327 for 1957. The ordinary dividend for the year is unchanged at 7½ per cent.

Vulcan Foundry, Ltd.—There is a group profit for 1958 of £125,780, as compared with a loss of £286,497 for the previous year. Taxation requires £50,000 and general reserve receives £25,000, leaving a net balance of £50,780. For the previous year, subvention payments of £335,000 were made from the English Electric Co. to cover losses, and after making deductions for taxation and general reserve, there was a net balance of £26,503. It is proposed to pay an ordinary dividend for 1958 of 5 per cent (against nil).

The annual meetings of the various companies in the group will be held on 19th March.

British Insulated Callender's Cables, Ltd., announces that its offers to acquire the whole of the preference and ordinary capital of the Telegraph Construction & Maintenance Co., Ltd., have up to date been accepted in respect of more than 96 per cent of the preference and 94 per cent of the ordinary shares of that company, and that the offers are now unconditional. Acceptances from the remaining shareholders of the Telegraph Construction & Maintenance Co. will be received until further notice.

Metal Industries, Ltd., has made an offer for the whole of the share capital of Avo, Ltd., manufacturers of electrical and electronic instruments and coil-winding machines, and the offer has been accepted in principle by the directors of Avo, Ltd. The terms of the offer are 10s in cash for each 2s ordinary share in Avo, Ltd., or, alternatively, one new ordinary share of £1 in Metal Industries, Ltd., for every four shares in Avo, Ltd. Shareholders holding not less than 60 per cent of the issued share capital of Avo, Ltd., have indicated that they will accept the offer for cash. Details of the offer will be announced shortly, with a recommendation from the board of Avo, Ltd., that it should be accepted.

Nuclear Investment Co., Ltd.—Particulars of this company have been published this week in connection with an application which has been made to the London Stock Exchange for quotation for the one-class capital. The company was formed in February last year, its objects being to acquire and hold securities primarily in companies engaged in and connected with the construction of nuclear reactors and power stations, the manufacture of electronic equipment, the development of electronic and mechanical processes in connection with automation, and the manufacture of instruments and control systems connected with nuclear energy, electronics and automation. The authorised capital is £200,000 in 5s shares, of which 400,000 shares are in issue while a further 200,000 shares are now being issued on a rights basis at 5s 1¼d each to shareholders.

International Combustion (Holdings), Ltd., reports that after meeting all charges, including £1,714,255 for taxation, the group profit for the year ended 30th September last is £1,371,472, as compared with £1,274,745 for the preceding year. General reserve receives £500,000, reserve for development and research £250,000 and investment reserve £100,000. It is proposed to pay a final dividend of 17½ per cent, maintaining the distribution for the year at 25 per cent, and in addition to pay a special interim dividend for 1958-59 of 5 per cent (against nil).

Radio & Television Trust, Ltd.—The directors have recommended ordinary stockholders to accept the offer of Crompton Parkinson, Ltd., to purchase their holdings of ordinary stock units of 6d each. Crompton Parkinson already own all the preference stock and £29,175 15s of the issued £56,250 ordinary stock of the Trust. As we reported in our issue of 6th February, the offer is 3s, payable in cash, for each 6d stock unit.

British Relay Wireless & Television, Ltd., is making a rights issue of new ordinary 5s shares at 20s each on the basis of two for every five ordinary shares held. New ordinary shares are also being offered on the same basis to holders of the convertible loan stock. The issue will raise more than £1,800,000.

The Dowty Group, Ltd., has announced an interim dividend of 5 per cent, payable on 6th March, and a further interim dividend of 6½ per cent to be paid on 8th May. There will be no final dividend and the total of 11½ per cent is the same as for the previous year.

The Telegraph Construction & Maintenance Co., Ltd., is paying a second interim ordinary dividend of 4¾ per cent.

Marryat & Scott, Ltd., have acquired the whole of the share capital of Austin Lifts, Ltd., Newcastle-on-Tyne. Marryat & Scott, Ltd., are one of the operating companies of Marryat & Scott Holdings, Ltd.

New Companies

Rolls-Royce & Associates, Ltd.—Registered 6th February. Capital £250,000. Objects: To carry on the business of making, releasing, storing, transmitting, converting, using, restoring and dealing in nuclear energy and designing and making apparatus utilising the same, ships, automobiles, aircraft, rockets, machinery and apparatus moving or stationary powered thereby, and processes, articles and things ancillary or useful to all the above, etc. The subscribers are: Rolls-Royce, Ltd.; Vickers, Ltd.; and Foster Wheeler, Ltd. So long as Rolls-Royce, Ltd. (and/or any assignee of shares from Rolls-Royce, Ltd.), hold not less than 52 per cent of the issued shares they may appoint and remove four directors (one to be chairman) and so long as Vickers, Ltd., and Foster Wheeler, Ltd. (and/or any assignee of shares from these companies) hold 24 per cent of the issued shares they may appoint and remove two directors respectively. Solicitors: Claremont Haynes & Co., Vernon House, Sicilian Avenue, W.C.1.

Matthews Electric, Ltd.—Registered 4th February. Capital £1,000. Manufacturers, importers, exporters, repairers and hirers of and wholesale and retail dealers in all kinds of electrical, motor, mechanical and non-mechanical vehicles, etc. Directors: L. H. Widdowson and M. L. Widdowson. Regd. office: Endurance Works, Maypole Fields, Cradley, Staffs.

G. E. Morgan (Electrical), Ltd.—Registered 30th January. Capital £5,000. To acquire the business of an electrical and radio and television engineer now carried on by G. E. Morgan at 28 and 30, Church Street, Rushden. Directors: G. E. Morgan and Evelyn M.

Morgan. Regd. office: 28, Church Street, Rushden.

F. Warren (Electrical), Ltd.—Registered 30th January. Capital £2,000. Manufacturers, wholesalers and retailers of radio, television, electrical, hardware and ironmongery, cinema and photographic goods and equipment, etc. Directors: D. K. Hughes and Mrs. Edith Hughes. Regd. office: 195, Newgate Street, Bishop Auckland.

Island Electrical Supplies, Ltd.—Registered 2nd February. Capital £100. Manufacturers of and dealers in electrical and electronic apparatus, etc. Directors: E. G. Taylor, F. Chiverton and J. A. K. Collins. Regd. office: 50a, Pyle Street, Newport, I.W.

Whitfield Bros. (Engineers), Ltd.—Registered 5th February. Capital £5,000. To acquire the business of Whitfield Bros., of 168, Liverpool Road, Cadishead, Manchester, and to carry on the business of electrical engineers, electrical installation contractors, etc. Directors: J. W. Whitfield and T. D. Whitfield.

Electra-Frame, Ltd.—Registered 5th February. Capital £100. Manufacturers and assemblers of and dealers in all types of sheet metal cases, electrical circuits and wiring, and commodities containing such materials, etc. G. J. Claremont is the first director. Regd. office: 18, Cricklewood Broadway, N.W.2.

Engine Applications, Ltd.—Registered 5th February. Capital £5,000. Agents for the importation, exportation and purchase and sale, and manufacturers of engines, transformers, electrical equipment, etc. J. P. Friswell signs as director. Regd. office: Swan Close Road, Banbury, Oxon.

H. Lee Electrical, Ltd.—Registered 6th February. Capital £1,000. Manufacturers of and dealers in artificial lighting apparatus, electrical plant, radio and television sets, etc. Directors: Miss Miriam Lee and Miss Regina Lee. Regd. office: 106, Golders Green Road, N.W.11.

Electrical Space Heating, Ltd.—Registered 11th February. Capital £1,000. Manufacturers of and dealers in heating, ventilating and temperature control plant, apparatus and instruments, etc. Directors: A. Kaye and E. C. Peckham. Solicitor: C. Caplin, 178/80, Piccadilly, W.1.

D.L. Electrical Supplies (Mitcham), Ltd.—Registered 6th February. Capital £5,000. Manufacturers of and dealers in electrical goods, etc. Directors: D. Levy, Rebecca Levy and L. Nicholsby. Regd. office: 46, Brook Street, W.1.

L. Newborough, Ltd.—Registered 6th February. Capital £600. Manufacturers and repairers of cathode ray tubes, etc. Directors: L. Newborough, D. Wallington and E. Cayless. Regd. office: 63, High Street, Malmesbury, Wilts.

Mayer's Electronics, Ltd.—Registered 10th February. Capital £10,000. Designers and manufacturers of and dealers in radio, television, electrical, electronic and telephone apparatus, sets and supplies of all kinds, etc. Directors: V. Mayer and Mrs. Mureen T. Mayer. Regd. office: 75, Penny Street, Blackburn.

W.E.A.R. Enterprises, Ltd.—Registered 11th February. Capital £1,000. Manufacturers, importers, exporters and distributors of, agents for and wholesale and retail dealers in electrical goods, equipment and apparatus, raido and television sets, etc. Directors: D. W. Smith and S. Preston. Regd. office: 77, Portland Place, W.1.

Liquidations

E. Dyne & Co., Ltd., electrical contractors, 70, Queen Victoria Street, London, E.C.4.—Winding up voluntarily. Liquidators, Mr. H. Evans, 2, Serjeants' Inn, London, E.C.4, and Mr. H. W. Pitt, 100, Park Street, London, W.1, appointed 30th January.

Tom Hall of Kettering, Ltd., suppliers of television and electrical equipment, and radio relay service, 24-25, Market Street, Kettering.—Winding up voluntarily. Liquidator, Mr. R. A. Palmer, 45, Sheep Street, Northampton, appointed 6th February.

Bankruptcy

H. Pointon, 33, Churchill Road, Cheadle, Staffs., electrician.—Public examination 19th March at the Town Hall, Hanley, Stoke-on-Trent.

VERITYS, LTD.

A BODY of creditors of Veritys, Ltd., who last year made a loss of £186,547, on 11th February urged the continuance of the company, in opposition to the Midland Bank, Ltd., which has presented a winding-up petition to the High Court. The company owes the Midland Bank £159,000.

When the bank brought its petition on 19th January for winding-up, the hearing was adjourned by Mr. Justice Roxburgh so that the views of trade creditors could be obtained.

At last week's meeting one of the resolutions urged that the High Court be asked to adjourn the petition for eight weeks to enable the company to put forward a scheme of arrangement or compromise with its creditors. Another resolution urged a similar adjournment and that the High Court be requested to extend the powers of the liquidator to enable him to carry on the business and to negotiate and advertise the sale of the business as a going concern. A third resolution sought a four-weeks' adjournment to enable the company to be wound up by means of a creditors' voluntary winding-up, and a fourth expressed support for the Midland Bank's petition.

Mr. W. G. Russell, a Birmingham accountant, who was appointed provisional liquidator by the Court, said that after the company, which employed 600 people, moved to fresh premises last year, they asked the Midland Bank to increase their borrowing limit from £75,000 to £125,000 to cover removal expenses, additional expenditure on plant and development of a department for the export market. This was to be repaid from the sale of the old works, but no sale resulted. After a further application for their borrowing limit to be increased by a further £50,000, he (Mr. Russell) was appointed financial adviser. On 19th December their overdraft had risen to £166,000, and trade creditors were in arrear to a total of nearly £200,000. In all, the general creditors amounted to £223,857 in addition to the unsecured debt to the bank of £166,000. The total loss for 1958 was £186,547. In fairness to the Midland Bank and especially in view of reports which had appeared in the press, he felt bound to point out that their action was taken as much in the interest of the general body of creditors as in their own. There was no question of foreclosure because the bank had no security on which to foreclose. It was simply that the bank considered it wrong for the company to go on trading when it could not pay its debts. He thought they were justified in reaching this conclusion.

Mr. E. G. Robbins, who began a move by trade creditors to oppose the Midland Bank's petition, said it was clear that the bank did a certain amount of good by bringing the matter to light, but he was surprised, in view of the solidarity of the creditors, that the bank went on with their application. He thought the bank might have been a little bit better disposed towards creditors generally than they had shown themselves up to now.

Mr. F. Tippetts, of the Wholesale Traders' Association, who represented over 100 creditors, said he thought the bank were a bit hasty in presenting their petition "out of hand"; they should have called all creditors together first. There were a lot of customers who would be very sorry if this company was not carried on.

Mr. Russell said he knew of no procedure whereby the bank could have called all creditors together before presenting their petition. In reply to further questions, he said he would be surprised if present losses were less than £5,000-£8,000 a month. Direct productive wages for last year were £89,000 and indirect wages, staff salaries and selling forces were over £200,000. In fairness to the present directors he ought to state that the running of this business was dominated by two caretaker directors for a considerable period, neither of whom was now on the board.

Mr. Tippetts suggested the setting up of an advisory committee to go into the feelings of all the creditors. For the Midland Bank, Mr. J. Campkin said that what they had done was done for the good of the creditors generally as much as for themselves. Referring to comments that the business had not been advertised for sale, he said it was a red herring to make that complaint, because the "bush telegraph service" in such matters would run like wildfire throughout the country. There had been no concrete proposals during the adjournment of the petition and in the circumstances it was the bank's view that no useful purpose would be gained in indulging in a gamble of whether they would be able to retain the necessary staff to carry on. The bank's action was a preferential claim, not a secured claim.

In the Chancery Division on Monday Mr. Justice Roxburgh adjourned for a further fortnight the petition for the winding up of the company.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1944

12896. Murphree, E. V.—Nuclear reactors. 6th July, 1944. (809061.)

1954

14689. Alfa-Laval Co., Ltd., and Corderoy, N.—Electrically conducting hose for milking machines. 19th May, 1955. (809111.)

16661. Hunt (Capacitors), Ltd., A. H.—Electrical capacitors. 3rd June, 1955. (809271.)

1955

9122. Foster Transformers, Ltd., and Jennings, R. E.—Electric arc welding systems. 28th March, 1956. (809124.)

10698. Radio Corporation of America.—Semiconductor devices and methods for their manufacture. 13th April, 1955. (808973.)

13714. Merles, A. J.—Systems for the automatic tuning of radio transmitters or receivers. 12th May, 1955. (808974.)

14745. Siemens & Halske A.G.—Coupling electrical elements. 23rd May, 1955. (809126.)

15374. Philips Electrical Industries, Ltd.—Processes of manufacturing luminescent silicates. 27th May, 1955. (809069.)

15747. Reyrolle & Co., Ltd., A.—Methods of manufacturing high-voltage switchgear components. 1st June, 1955. (809285.)

18498. Mullard Radio Valve Co., Ltd.—Electric circuits employing transistors. 27th June, 1956. (809115.)

20203. Siemens-Schuckertwerke A.G.—Automatic feed-water control of forced circulation boilers. 12th July, 1955. (809287.)

21744. Compagnie Industrielle Française des Tubes Electroniques.—Electron tubes. 27th July, 1955. (809128.)

23334. General Electric Co., Ltd.—Transistors. 13th August, 1956. (809071.)

23466. Bendix Aviation Corporation.—Magnetic mixing and amplifying devices. 15th August, 1955. (809252.)

24970. Leroy, E. M. P.—Railway track-circuit signalling system. 31st August, 1955. (809156.)

26907. Licentia Patent-Verwaltungs-G.m.b.H.—Electric switching device for effecting sequential switching operations. 20th September, 1955. (809253.)

27429. Veb Vakutronik.—Electron microscopes of high resolving power. 27th September, 1955. (809193.)

27709. Slee, K. V.—Electric resistance welding machines. 28th December, 1956. (809073.)

28008. Libbey-Owens-Ford Glass Co.—Electrically conducting glass. 1st October, 1955. (809074.)

30361. Clarke, Chapman & Co., Ltd.—Tubular heat exchangers. 24th October, 1956. (809158.)

31982. United Kingdom Atomic Energy Authority.—Switching systems for reversing electromagnets. 9th November, 1956. (809076.)

32610. Veb. Werk für Fernmeldewesen.—Electrical circuit arrangements for the simulation of a musical instrument. 15th November, 1955. (809077.)

33880. General Electric Co.—Apparatus for generating gaseous working fluid. 25th November, 1955. (809031.)

36847. Chicago Telephone Supply Corporation.—Combined variable resistor and switch for use with printed circuits. 22nd December, 1955. (809256.)

1956

2522. Thorn Electrical Industries, Ltd.—Electrical indicator lamp assemblies. 9th January, 1957. (809130.)

3816. Licentia Patent-Verwaltungs G.m.b.H.—Methods of manufacturing selenium rectifiers. 7th February, 1956. (809080.)

4025. Belling & Lee, Ltd.—Electrical plugs. 11th January, 1957. (809131.)

5194. Muirhead & Co., Ltd.—Protective apparatus for electro-sensitive paper recorders. 8th February, 1957. (Addition to 736428.) (809007.)

8601. Standard Telephones & Cables, Ltd.—Selective signalling arrangement for radio channels. 20th March, 1956. (809232.)

12981. Standard Telephones & Cables, Ltd.—Multicontact electromagnetic relays. 27th April, 1956. (809083.)

13043. Pechiney Compagnie de Produits Chimiques et Electrometallurgiques.—Electrolytic cells. 27th April, 1956. (809299.)

13797. English Electric Co., Ltd.—Commutators for dynamo-electric machines. 1st May, 1957. (809038.)

13963. Rushworth, D.—Apparatus for supplying power to an electrically or pneumatically operated coal cutter or the like. 2nd August, 1957. (809008.)

16226. Hollins, J. R.—Thermo-electrically controlled latch. 25th May, 1956. (808989.)

16231. Bell, C. F.—Electrically operated acoustic signalling devices. 25th May, 1956. (808990.)

20220. Mullard Radio Valve Co., Ltd.—Electric circuits employing transistors. 29th June, 1956. (Divided out of and addition to 809115.) (809116.)

21395. Research Corporation.—Magnetically controlled gating element. 10th July, 1956. (809205.)

23139. Philips Electrical Industries, Ltd.—Magnetic positioning devices for electric switches and keys. 26th July, 1956. (809090.)

23306. Standard Telephones & Cables, Ltd.—Railway route setting equipment. 27th July, 1956. (809041.)

24147. Philco Corporation.—Electrolytic processes. 7th August, 1956. (809262.)

27636. Collins Radio Co.—Electronically switched differentiating or rate of change circuit. 10th September, 1956. (809091.) 28523. Reactance tube circuit. 18th September, 1956. (809141.)

29060. Burndy Corporation.—Electrical multiple connector. 24th September, 1956. (809142.)

30447. Standard Telephones & Cables, Ltd. (Laboratoire Centrale de Telecommunications S.A.).—Electrical data processing equipments. 5th October, 1956. (809045.)

31924. Siemens Edison Swan, Ltd.—Electron discharge tubes. 16th October, 1957. (809170.)

32314. Murray, J. S.—Transistor amplifiers. 23rd October, 1956. (809207.)

36725. Maschinenfabrik Oerlikon.—Turbines. 30th November, 1956. (809268.)

37820. Philips Electrical Industries, Ltd.—Stud welding. 11th December, 1956. (809049.)

38674. Westinghouse Electric International Co.—Electric amplifier apparatus. 19th December, 1956. (809176.)

1957

179. General Motors Corporation.—Transistor oscillator and rectifier devices. 2nd January, 1957. (809096.)

710. Westinghouse Electric International.—Electron discharge devices. 8th January, 1957. (809017.)

2651. Foxboro Co.—Radioactive measuring system density compensation. 24th January, 1957. (809018.)

2868. Signal-Stat Corporation.—Time delay devices. 25th January, 1957. (808998.)

3979. Collins Radio Co.—Pulse stretching phase detector. 5th February, 1957. (809177.)

5215. Standard Telephones & Cables, Ltd.—Metal rectifier stack assemblies. 15th February, 1957. (808999.)

6022. English Electric Co., Ltd.—Electromagnetic deflection circuit arrangements for cathode-ray tubes. 8th October, 1957. (809019.)

6761. Deutsche Gold- und Silber-Scheideanstalt vorm. Roessler.—Method of operating high-vacuum induction furnaces. 28th February, 1957. (809270.)

7151. Siemens & Halske A.G.—Teleprinter transmitters. 4th March, 1957. (809211.)

10562. Siemens-Schuckertwerke A.G.—Processes for influencing the molecular structure of plastics by irradiation, more especially with electrons. 1st April, 1957. (809183.)

11503. Handwerk, J. H., Noland, R. A., and Walker, D. E.—Fuel elements for nuclear reactors. 9th April, 1957. (809280.)

22112. Babcock & Wilcox, Ltd.—Steam generating and superheating plant and method of producing low pressure superheated steam. 12th July, 1957. (809240.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates stated:—

28th February

Roboter. No. 781,010. Class 8. Electric shaving instruments.—Ariel Heller, 133, Moorgate, London, E.C.2.

Satellite. No. 776,730. Class 9. Electric batteries for torches, cycle lamps and the like.—Hing Wah Battery Factory, Hong Kong. Address for service, c/o Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.2.

Stenarc. No. 782,342. Class 9. Electrical apparatus (not machines) for use in arc welding, cutting, brazing and the like heat treatment of metals.—British Oxygen Gases, Ltd., Bridgewater House, Cleveland Row, St. James's, London, S.W.1.

Zelec. No. 780,559. Class 11. Refrigerating apparatus and instruments.—Zero Electric, Ltd., 39a, Bath Road, Walsall, Staffs.

4th March

Elcontrol. No. 765,042. Class 9. Electronic apparatus for the automatic control of industrial operations, checking and counting articles, etc.—Elcontrol, Ltd., Wilbury Way, Hitchin, Herts.

Tonotron. Nos. 778,859-60. Class 9. Cathode ray tubes.—Hughes Aircraft Company, Culver City, California. Address for service, c/o Carpmaels & Ransford, 24, Southampton Buildings, Chancery Lane, London, W.C.2.

Westrex. No. 781,200. Class 9. Radio and inductive communication apparatus and instruments, and public address apparatus.—Westrex Corporation, New York. Address for service, c/o F. C. Tomlins, 14, Alderton Hill, Loughton, Essex.

Cadet and **Gold Crest.** Nos. 781,886-7. Class 9. Electric batteries and parts and cases for batteries.—Buckland Battery Co., Hersham Trading Estate, Walton-on-Thames, Surrey.

Witlite. No. B780,894. Class 11. Holders for fluorescent lighting elements for attachment to street lamp standards.—James Whitson & Co., Ltd., High Street, Yiewsley, West Drayton, Middx.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 23rd FEBRUARY

Birmingham.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midland Radio and Measurement Group. "Computing Principles and Applications," by A. St. Johnston.

Bristol.—Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Utilisation Group. "The Use of Steel-Tank Mercury-Arc Invertors for Generating Medium Frequencies for Induction Heating," by D. L. Smart and J. J. L. Weaver.

Grand Hotel, 7.30 p.m. Institute of Marine Engineers, West of England Section. Films on "How a Thermal Reactor Works," and "Construction of Calder Hall," followed by the annual general meeting.

Leicester.—East Midlands Electricity Board, Charles Street, 7 p.m. I.E.S. Leicester Centre. "Cosmetics and Lighting."

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "A Simple Investigation of the Cross-Modulation Distortion arising from the Pulling Effect in a Frequency-Modulated Klystron," by D. Gjessing; "Theory and Behaviour of Helix Structures for a High-Power Pulsed Travelling-Wave Tube," by G. W. Buckley and J. Gunson; "A Multi-Cavity Klystron with Double-Tuned Output Circuit," by H. J. Curnow and L. E. S. Mathias; and "A Method for the Measurement of Very High Q-Factors of Electromagnetic Resonators," by F. H. James.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "Operational Experience at Calder Hall," by K. L. Stretch.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. "Development of High-Voltage Air-Break Circuit-Breakers with Insulated Steel Plate Arc Chutes," by F. S. Fay, J. A. Thomas, D. Legg and J. S. Morton.

TUESDAY, 24th FEBRUARY

Coventry.—Training Office, G.E.C., Stoke, 7 p.m. I.E.E. South Midland Graduate and Student Section. "Transistor Pulse Amplifiers," by A. L. Stelmach.

Farnborough.—Technical College, Boundary Road, 6 p.m. I.E.E. Southern Centre. "Nuclear Energy," by D. W. Fry.

Galashiels.—I.E.E. South East Scotland Sub-Centre. District meeting. "Installation Inspection," by E. J. Sutton.

Glasgow.—425, Sauchiehall Street, C.2. Institution of Heating and Ventilating Engineers, Scottish Branch. "Air Conditioning—Some Industrial Applications," by H. Poole.

Henlow.—R.A.F. Technical College, 7.30 p.m. I.E.E. London Graduate and Student Section. District meeting. "The Tracking of the Russian Earth Satellite," by D. L. Cooper-Jones.

London.—At the I.E.E., Savoy Place, W.C.2, 6.30 p.m. A.S.E.E. London National Lecture. "Hospital Electrical Installations and Apparatus," by J. W. J. Leslie.

Connaught Rooms, W.C.2, 12.15 for 12.45 p.m. Radio Industries Club. Luncheon. Speaker, Mr. Gerald Nabarro, M.P.

Manson House, Portland Place, W.1, 6 p.m. Society of Instrument Technology, London Section. Symposium on "Automatic Weight Control in Industry."

Manchester.—Free Trade Hall, 7.30 p.m. I.E.E. North Western Centre. Faraday Lecture. "Automation," by Dr. H. A. Thomas.

Newcastle-on-Tyne.—Crown Hotel, 7.30 p.m. A.S.E.E. Tyneside Branch. Lecture by a factory electrical inspector.

WEDNESDAY, 25th FEBRUARY

Birmingham.—Grand Hotel. Institution of Heating and Ventilating Engineers, Birmingham and District. Ladies' evening.

Cardiff.—Welsh College of Advanced Technology, 6.45 p.m. Society of Instrument Technology, South Wales Section. "The Development of Flow Measurement," by B. L. Thurley.

Chester.—Grosvenor Museum, Grosvenor Street, 7 p.m. Society of Instrument Technology, Chester Section. "Automatic Boiler Control," by J. E. O'Breen.

Chippenham.—Westinghouse Brake & Signal Co., Ltd., 6.30 p.m. I.E.E. Bristol Graduate and Student Section. "Applications of Light Sensitive Cells," by K. I. Bartlett.

Glasgow.—39, Elmbank Crescent, 7 p.m. I.E.E. South West Scotland Sub-Centre. "Generation of Electricity in the London Area," by H. V. Pugh.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Development of High Voltage Air Break Circuit-Breakers with Insulated Steel Plate Arc Chutes," by F. S. Fay, J. A. Thomas, D. Legg and J. S. Morton.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Patents and the Radio Engineer," by E. D. Swann.

45, Great Peter Street, Westminster, S.W.1. 7 p.m. Women's Engineering Society, London Branch. Film evening. "Conquest of the Atom," and other films.

Port Talbot.—Old Head Office, Steel Company of Wales, Ltd. Combustion Engineering Association, Western Region, 11 a.m. "Reactor Engineering," by J. W. Ashley; 2.15 p.m. "The Refining of Crude Oil and the Use of the Products," by R. R. B. Cox.

Rugby.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Storage and Manipulation of Information in the Brain," by Dr. R. L. Beurle.

Stafford.—Swan Hotel, 7.45 p.m. I.E.E. North Staffordshire Graduate and Student Section. Students' lecture. "Something for Nothing? Heat Pump Achievements," by G. O. Maclean.

THURSDAY, 26th FEBRUARY

Bristol.—I.E.E. Bristol Graduate and Student Section, 7.30 p.m. Visit to Telephone Exchange.

Royal Hotel, College Green, 7 p.m. Institute of Metal Finishing, Bristol and South West Branch. Annual dinner-dance.

Croydon.—Greyhound Hotel, High Street, 8 p.m. A.S.E.E. South London Branch. "A.C. Motor Control Gear," by W. G. Stoner.

Grangemouth.—Leapark Hotel, 7 p.m. Society of Instrument Technology, Grangemouth Section. "Design Characteristics of Control Valves," by A. M. Reid.

Hove.—New Imperial Hotel, First Avenue, 7.30 p.m. A.S.E.E. Brighton, Hove and District Branch. "Modern Electric Motor Specification."

Hull.—Yorkshire Electricity Board Offices, Ferensway, 6.30 p.m. I.E.E. North Midland Centre. District meeting. "Recent Developments in Medium-Voltage High-Breaking Capacity Fuse Links," by R. H. Dean.

Liverpool.—Philharmonic Hall, 6.45 p.m. I.E.E. Mersey and North Wales Centre. Faraday Lecture. "Automation," by Dr. H. A. Thomas.

London.—Grosvenor House, Park Lane, W.1, 7 for 7.30 p.m. Institution of Electrical Engineers. Annual dinner.

Connaught Rooms, W.C.2, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Luncheon. Guest speaker, Sir Christopher Hinton.

Solihull.—George Hotel. I.E.E. South Midland Graduate and Student Section. Annual joint dance.

FRIDAY, 27th FEBRUARY

Birmingham.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. Annual general meeting followed by an address by the president.

Cheltenham.—North Gloucestershire Technical College, 7 p.m. British Institution of Radio Engineers, South Midlands Section. "Micro-miniaturisation," by G. W. A. Dummer.

Glasgow.—425, Sauchiehall Street, 7.15 p.m. Society of Instrument Technology, Scottish Section. "Data Handling in the Process Industries," by A. Parsons.

London.—1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers. Discussion on "Choice of Gas Temperature and Steam and Pressure Conditions in Nuclear Power Stations."

14, Rochester Row, S.W.1, 7 p.m. Junior Institution of Engineers. "Computers and Materials Handling," by W. J. Kease.

Dorchester Hotel, W., 7.30 for 8 p.m. Radio Industry Golfing Society. Annual dinner and ball.

Manchester.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers: "Electrical Models and Analogues," by Professor E. Bradshaw.

Manchester College of Science and Technology, 7 p.m. Institution of Electronics, Northern Division. "Electronics in Industry—Including Computer Applications," by R. S. Evans.

Newcastle-upon-Tyne.—Literary and Philosophical Society, 6.15 p.m. North East Coast Institution of Engineers and Shipbuilders. "Some Engineering Developments in the Nuclear Power Field," by Dr. A. T. Bowden.

Weymouth.—South Dorset Technical College, 6.30 p.m. I.E.E. Southern Centre. "Survey of Recent Developments in Marine Radar," by A. L. P. Milwright.

SATURDAY, 28th FEBRUARY

London.—I.E.E. London Graduate and Student Section, 3 p.m. Visit to Tower Bridge.

Street Lighting Notes

Bournemouth Highways and Works Committee proposes that for side road lighting, gas lighting should be replaced by electric lighting to Group "B" standard over a period of ten years and that a sum of £20,000 should be included in the estimates each year to enable the work to proceed.

Chippenham Town Council is to spend £12,500 over the next five years improving the street lighting.

Gillingham Corporation is to spend £11,500 on improvements to street lighting during next year.

Houghton-le-Spring U.D.C. is to re-submit to the Ministry of Transport street lighting conversion schemes estimated to cost more than £15,000. Loan sanction is also being sought to cover the cost.

Nuneaton Corporation is recommended to approve schemes, estimated to cost £5,790 for improvements to the street lighting in Church Road, College Street, Haunchwood Road, Heath End Road and Tomkinson Road.

South Shields Town Council is to convert 650 street gas lamps to electricity at a cost of £26,000. The work is expected to be spread over three or four years.

Stourport U.D.C. has agreed in principle to four street lighting schemes costing £5,277.

Sunderland Town Council is being recommended to spend £20,000 during 1959 on improving street lighting in the Southwick area.

Wood Green Works and Highways Committee has approved a scheme submitted by the borough engineer for re-lighting the part of the borough at present lit by gas. The total cost of the scheme, which provides for sodium lamps on concrete columns, is £84,369.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Alvaston and Boulton.—Parish Council. 4th March. Trunk road lighting equipment. (See this issue.)

Australia.—Metropolitan Water Sewage and Drainage Board, Sydney. Three 200 kVA and three 800 kVA transformers. (E.S.B. 3539/59. Ten/37286.)*

Burma.—Burma Purchase Board, Rangoon. 26th February. V.i.r. cable. (E.S.B. 3529/59. Ten/37282.)*

Canada.—Winnipeg Hydro-Electric System. 25th February. Supervisory control equipment. (E.S.B. 3426/59. Ten/37230.)*

Formosa.—Central Trust of China, Taipei. 25th February. Condensers and reactors. (E.S.B. 4208/59. Ten/37435.)*

Honiton.—East Devon Water Board. 2nd March. Two electrically driven pumps and ancillary equipment for Charmouth water supply. Engineer to the Board, The Laurels, 46, New Street.

Iraq.—Directorate General of Municipalities, Baghdad. 7th March. Thirty transformers for Kirkuk Water and Electricity Board. (E.S.B. 3225/59. Ten/37184.)*

Irish Republic.—Engineering and Town Planning Department, Dublin. 27th February. Sheet metal relay boxes. (E.S.B. 3445/59. Ten/37285.)*

Iriam.—U.D.C. 28th February. Electric lamps for the year ending 31st March, 1960. Surveyor, Council Offices.

London.—India Store Department. 23rd March. Electric spot welding machine. (See this issue.)

New Windsor.—Borough Council. 25th March. Electrical installations in 114 houses at Smiths Lane site, Windsor. Particulars from the borough engineer, Kipling Building, Alma Road, Windsor.

Oswestry.—Corporation. 14th March. Supply and installation of equipment for forty-seven 140 W sodium and fifteen 400 W colour corrected mercury street lamps. D. H. Dickinson, borough engineer, Guildhall.

Pakistan.—Government Department of Supply and Development, Chittagong. 24th February. V.i.r. cable. (E.S.B. 3607/59. Ten/37272.)* 25th February. Wind-power generators, oil pressure testing equipment, transformer, automatic starting switches, tape recorders and electrical domestic appliances. (E.S.B. 3601/59. Ten/37266.)* 26th February. One 150 kVA transformer, switchgear, electric light fittings and cable. (E.S.B. 3602/59. Ten/37273.)* 3rd March. Armoured cable. (E.S.B. 3604/59. Ten/37269.)* 5th March. Substation switchboard. (E.S.B. 3606/59. Ten/37270.)*

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 27th February. Mobile radio equipment units. (E.S.B. 3532/59. Ten/37262.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 4th March. Insulating bushings. (E.S.B. 2964/59. Ten/37170.)*

Stockton-on-Tees. — Corporation. 7th March. Trunk road lighting equipment. (See this issue.)

Sunbury-on-Thames.—U.D.C. 2nd March. Sodium vapour street lighting with 462 Group "A" concrete columns and 108 Group "B" concrete columns. Surveyor, Council Offices, Green Street.

Thailand.—Thai Technical and Economic Committee, Bangkok. 26th February. Radio transmitters and receivers. (E.S.B. 3476/59/I.C.A. Ten/37289.)*

Tredegar.—U.D.C. 28th February. Street lighting equipment. (See this issue.)

Vietnam.—Vietnam Textile Co., Ltd., Saigon. 28th February. Power house equipment, including control panels, power transformers, l.v. switchboard and 600 V cable, and steam generating unit and air conditioning system. (E.S.B. 3031/59/I.C.A. Ten/37195.)*

Wandsworth.—Borough Council. 4th March. Cable. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Glasgow. — British Railways, Scottish Region. Accepted. Glasgow suburban electrification: Train describer apparatus, Newton.—Standard Telephones & Cables, Ltd. Telephones and associated apparatus, Kelvinhaugh Junction to Airdrie.—Ericsson Telephones, Ltd. Installation of 25 kV gas-filled power cable and associated pilot cable between Parkhead feeder station and Finnieston sub-feeder station and between Finnieston sub-feeder station and Westerton sub-feeder station.—W. T. Glover & Co., Ltd.

Education Committee. Electrical rewiring works, etc., at Wolseley Street School (£4,761), Bankhead School (£6,127) and Sacred Heart Secondary School (£6,686).—Corporation Housing and Works Department.

Rotherham.—Education Committee. Rewiring of grammar school including the supply of the necessary lighting fittings (£5,050).—Yorkshire Electricity Board.

Stoke-on-Trent.—City Council. Recommended. Lighting of various main traffic routes (£17,979).—G.E.C.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Abbey Wood.—Works extensions; British Domolac, Ltd., Harrow Manor Way.

Aldershot.—Erection of All Hallows R.C. Secondary School; Goodhart-Rendel, Broadbent and Curtis, architects, 22, Whitehall, London, S.W.1.

Barnsley.—Handicapped persons' centre, Broadway (£98,000), new police headquarters and Town Hall extensions; Lanchester & Lodge, architects, 10, Woburn Square, London, W.C.1.

Basford.—Houses (172); J. J. G. Ellis, housing architect, Rock House, Stockhill Lane, Basford, Nottingham.

Bath.—Houses (86), Twerton/Whiteway estate; city planning officer, 7, North Parade Buildings.

Beddington and Wallington.—Flats (42); A. B. Bateman, town clerk, Town Hall, Wallington, Surrey.

Bedford.—New factory, Manton's Lane; Texas Instruments, Ltd., Dallas Road.

Berkshire.—Large extensions to Easthampstead Park Teachers' Training College (£346,000); county architect, Wilton House, Parkside Road, Reading.

Blaydon (Co. Durham).—Houses (120), for U.D.C.; N. Young, housing architect.

Carlisle.—Swimming baths; city engineer, 18, Fisher Street.

Castleford.—Houses (68), Half Acres; E. Hutchinson, town clerk, Town Hall.

Cleethorpes.—Further 48 flats for old people, Gunby Place and Thornton Place; borough surveyor.

Cumberland.—Proposed secondary school at Penrith, and additions to Whitehaven Grammar School, White House Grammar School, Cockermouth Grammar School, Thornhill Junior School, and Whitehaven St. James School for the C.C.; county architect, Portland Square, Carlisle.

Easington.—Houses (159) for old people; R.D.C. surveyor.

Enfield.—Flats (30), Lancaster Road; H. D. Peake, borough engineer, 7, Little Park Gardens.

Epping.—St. John's C.E. School (£116,000); Pavitt Bros., Ltd., builders, Aveley, Purfleet.

Godmanchester.—Two further blocks of flats, Cambridge Road site; borough surveyor.

Grantham.—Houses (180); borough engineer, Guildhall.

Great Casterton.—New C.E. primary school; county architect, Oakham, Rutland.

Hove.—Flats (84), Coombe Lea site; Wellwood Estates, Ltd., 25, Ebury Street, London, S.W.1.

King's Lynn.—Twin operating theatre unit, West Norfolk and King's Lynn Hospital; Warren Bros., Ltd., builders, Clenchwarton.

London.—Showrooms and offices, Cheapside and Pancras Lane, E.C.; Kenneth Lindy, Joseph Hill & Partners, architects, 24, St. Mary Axe, E.C.3.

Works, Garratt Lane, Wandsworth; Super Ducts, Ltd., 24, Speke Road, S.W.11.

Houses, Spital Street (57), and Sidney Street (32); Stepney borough engineer, Municipal Offices, 227/233, Commercial Road, E.1.

Lowestoft.—Additional factory, Whapload Road; Birds Eye Foods, Ltd., London Road.

Manchester.—Church, Longhirst Road, Higher Blackley; S. Clough, architect, 7, Cudworth Road, Higher Blackley.

Erection of Harpurhey Technical High School (£228,618) and Clough Top Secondary School (£165,309); L. C. Howitt, city architect, Town Hall.

Newcastle-on-Tyne.—Shops, etc., Newgate Street, for Chatsworth Investments, Ltd.; E. M. Lawson, architect, Barras Buildings, Barras Bridge.

Proposed new St. Mary Magdalene Hospital, Claremont Road; G. H. Gray & Partner, Portland Terrace.

Paisley.—Extensions to grammar school (£200,000); Blackburns, Ltd., builders, Castle Road, Dumbarton.

Richmond (Surrey).—Flats (42), North Road, Kew; borough engineer.

Romford.—Factory; Colvern, Ltd., London Road.

Houses (111), Hutton estate; Carlton Contractors, Ltd., Carlton House, Epsom.

Rotherham.—Police traffic headquarters (£38,000), fire station and firemen's houses (£51,000), swimming baths (£150,000) and crematorium (£35,000); E. J. Manson, borough engineer, Municipal Offices.

St. Austell.—Houses (81), Boldventure (Bethel) site; H. G. King, surveyor, Municipal Offices, Truro Road.

Street.—College; R. O. Harris, architect, Park Street, Taunton.

Uttoxeter.—Houses (92), Copes Park estate; J. H. Kenny, clerk, Old Bank House, 72, High Street, Uttoxeter, Staffs.

Wallsend.—Houses (354), Willington Square; town clerk, Town Hall.

Wortley.—Houses (104), Burncross Road, Chapeltown; A. Wikeley, surveyor, Council Offices, Grenoside, Sheffield.